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The Hill Automatic Grain Scale.

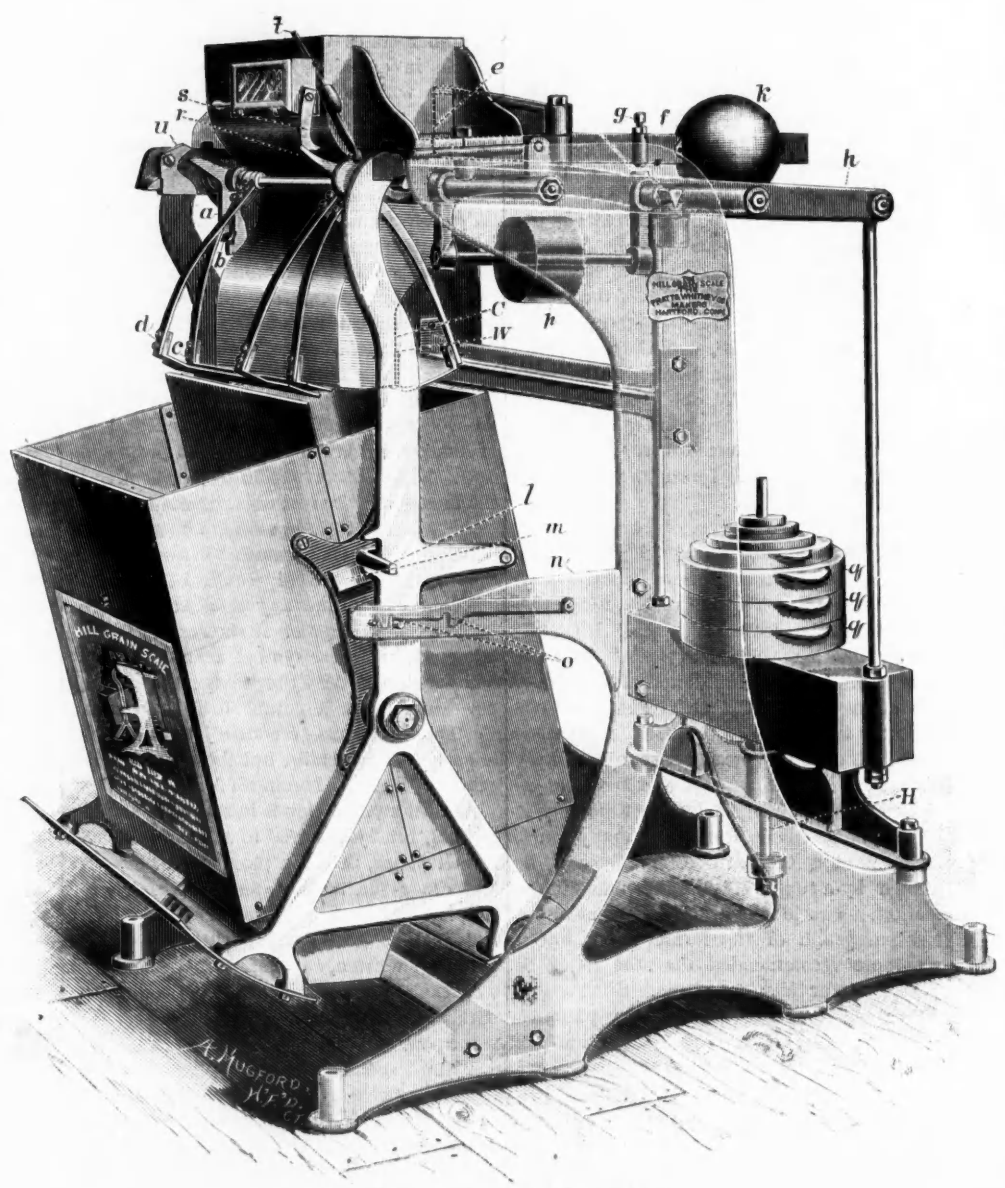
Much ingenuity has been expended first and last, in devising mechanisms for the automatic weighing of grain, in warehouses, elevators, mills, and other places where grain is handled; and it is, of course, a prime necessity in such machinery that it should be absolutely accurate and infallible, and continue to be so, with the least possible liability to derangement and consequent error.

The illustration on this page is of the Hill Automatic Grain Scale, made by The Pratt & Whitney Co., Hartford, Conn. In this scale no springs of any kind are used; gravity is the only force which acts upon its mechanism. The weights *q q q* determine the amount of grain to be weighed at each draft. They are suspended from the end of the levers *h*, and when a sufficient amount of grain has passed from the hopper to the bucket to overbalance them, these levers rise, and in doing so move the valve *c* under the hopper, and reduce the flow of grain to a very small stream. When a further quantity of grain has flowed through this reduced opening, sufficient to overcome the supplementary weight *k*, it also rises, and the lever upon which it is placed closes the valve *d*, shutting off the flow of grain entirely. The bucket then continues to sink until the latch *l* comes in contact with the arm *n*, which holds it up, and the downward motion of the bucket continuing, the latch is disengaged from the latch-block *m*, opening a passage for the grain at the bottom; the bucket tips, discharging the grain rapidly, closing the bottom of the other compartment and rising to the initial position, when the other compartment is filled and acts upon the mechanism as before; alternate compartments being filled at each draft, and the operation continuing as long as grain is supplied.

The action of the valves *c* and *d* is controlled by the set screw *g*, which may be adjusted until a proper action is secured. The counterpoise weight *p* is used to make the scale agree with the standard mill scale. It can be adjusted along the rod for this purpose, and when exactly right, made fast by a set screw.

On the front of the hopper is a counter having five dials, which show at any time the number of dumps which have taken place, and by inserting screw-pins in these dials in the proper holes, it can be made to stop automatically at any desired number of dumps, so that the machine can be set for any desired amount of grain and left to itself; and when the pre-determined amount is reached, the machine stops. This action is effected by the movement of the pawl *s*, which is turned with its shaft by the action of the stop motion of the counter, and releases the valve lever *r*, allowing the valve opposite the valves *c* and *d* to close and shut off the flow of grain. The catch *o* serves to stop the vibration of the bucket suspenders after each dump.

Knife edges are used throughout, for the bearings which affect the sensitiveness of the scale, and no oil is used upon any part of it. As will be seen, the machine is quite simple, when the functions performed by it are taken into consideration, and the fact that it is built by The Pratt & Whitney Co. is a sufficient guarantee as to workmanship.



THE HILL AUTOMATIC GRAIN SCALE.

Manufacturing Names and Symbols.

BY OBERLIN SMITH.

FIRST PAPER.

We are told in Holy Writ that Adam, at the command of his Lord, gave to every beast of the field and every fowl of the air a *name*, and that by such name was it to be called. Nothing is said about two or three different names for one creature, and some poor creatures with interchangeable names, or with none at all. Such foolishness did not occur to the mind of primitive man; and pity 'tis that in the noble and presumably systematic profession of mechanical engineering there should be such a faulty and indefinite nomenclature for machinery, and the component parts thereof—as well as for operations of work upon the same.

A reform of this evil has been attempted by the writer in one particular field, viz., the commercial and shop appellations of manufactured articles and their separate pieces. He first treated this subject in a paper entitled "Nomenclature of Machine Details," read before the American Society of Mechanical Engineers in 1881. This was published in vol. 2, page 358, of its "Transactions," and also in the AMERICAN MACHINIST for Sept. 10, 1881. As the system of symbols therein described has been, in its main features, endorsed and adopted by so good an authority as Capt. Henry Metcalfe (who has printed the paper entire in his "Cost of Manufactures," p 110, etc.), there possibly is in it a germ of good which may be developed into a useful general system. Of the necessity of "crispiness" of nomenclature in this field, as well as in many others of our intense modern life, it is hardly worth while to speak—in an era when nobody has time to call an elevated railway anything more than an "L."

This present paper is intended to supplement and somewhat modify the former one, and contains ideas which have been derived from more recent study and experience. An attempt has been made to avoid a common defect in essays of this kind, which are frequently a mere record of somebody's personally adopted system that has worked fairly well with the users, because it has grown up with their particular necessities. Such systems usually fall to the ground when the conditions surrounding them happen to change a little. To be generally useful a system of names and symbols such as we are considering must be thoroughly *comprehensive*, perfectly *definite*, *logical* in its sequences, and *elastic* enough to be adaptable to various kinds of manufacturing business.

Such a general system the writer has not been able to find in actual use, although he has recently taken pains to collect perhaps half a bushel of pamphlets, giving numbered lists of pieces, etc., which have been furnished through the kindly courtesy of various manufacturers of reapers, pistols, and sewing machines. In many of these the separate pieces of an article produced are designated simply by a number; but, as these numbers are repeated in other articles of other sizes and kinds, no piece can be individually identified without mentioning the full name of the article as well as the number. Thus a customer may want what is known by its full name, as a "knife-bar crank-nut, etc," but finds he can abbreviate only to the extent of asking for: "Piece No. 163 for Diminutive Giant Self-Raking Reaper, pattern of 1887," and the same brief (?) appellation may have to be inscribed upon the drawings, patterns, jigs, and other special tools used in its construction. Other makers use a number prefixed by a letter for the symbol of a piece, as, "M 163," etc. Here M stands for the complete article, but, as pointed out in the former paper, such a system is usually entirely inadequate for all the sizes and kinds of all the various articles that a given manufacturer does make, ever has made, or ever will make—together with all the modified and improved patterns of the same that may be developed. This is obviously because our alphabet has but 26 letters. As before shown, the use of two letters (giving 676 symbols) is hardly a safe allowance for all contingencies during the whole lifetime of a general manufacturing business; and therefore the use of three letters, with their enormous number of permutations, was recommended.

While criticizing the present methods, it may be remarked that the words "pieces," "parts," "duplicate parts," "repairs," etc., are used synonymously. Also, that fractional numbers are sometimes used in symbols where some new piece has been interpolated. Also, that while a symbol usually stands for a separate piece, it is sometimes applied to a group which are sold in an assembled condition, as a bolt *with* its washer and nut, etc.; or, "reverse" pieces are given the same number, with the "words "right-hand" or left-hand" suffixed. Now these things are foolish. Undoubtedly it is better always to use the same general name, and

"piece" seems the best one. There is no need for fractions if proper "gaps" are left in the numbering, so that added pieces may find their place in congenial groups; and in occasionally grudging some piece a number all to itself (because it has a right or left-hand twin brother) the logic is not apparent—while numbers remain numerous.

It is evident that the object of symbols in manufacturing is to identify, without question, not only a given piece of an article, distinguishing it from all the other pieces, but to know the article itself from all other articles, both of the same type and of totally dissimilar types, made by the same concern. It is also necessary, in the commercial aspect of the case, to know any article and all its pieces from similar or dissimilar things made by any other concerns. For want of better words, "concern" will be herein used for the person, firm or company manufacturing things; and "article" for each complete thing made—usually perhaps a *machine*, but not necessarily so, although in the former paper the word "machine" was used for any article to be symbolized.

Now it is obvious that unless all the manufacturers in the world could form a syndicate to promote as many distinct systems (instead of adopting a common one, as this paper advocates), the name of the *concern* must be affixed to the *symbol* of the article or piece in question—that is, for commercial purposes, outside of the factory where it is made. In ordering goods, this is of course no trouble, as the concern has to be addressed any way, and after that the symbol only may be used. If the logical system here advocated is strictly carried out, nothing else is necessary—as the concern will never in its lifetime use the same symbol for any two dissimilar things.

In the factory itself everything can be identified by the symbols only, unless it has come from some outside concern, in which case such concern's name would of course be appended.

Among the desirable modifications and amplifications of the system given in the former paper, is: First—Option to use figures or partly figures, for the characters of the *article-symbol*, instead of exclusively letters—also to have two, three or four, instead of always three of these characters. If a concern started to use figures only, there would be but a passible 999 kinds and sizes of articles. If, however, this proved too few, it would be easy to fall back afterward upon letters—though at some sacrifice of uniformity.

The object of using any figures is to make a symbol which will, to some people's taste, look better and sound better as part of a *commercial name* for the article represented, than would one composed of all letters. Thus, a manufacturer might like better to advertise in his catalogue "Lathe 234," or "Lathe B34," or "Lathe 23D," or "Lathe B3D," rather than "Lathe BCD."

The most common present method for the commercial identification of any article which is one of a series, is to prefix to its descriptive name the word "Number" (or the abbreviation "No.") and some figures, as: "Number double-nought Pitcher-spout Force Pump, new pattern," or "Number three-and-a-half-Engine Lathe, gibbed rest," or "Number five Geared Power Drawing Press." The adjectives placed before or after the principle noun are usually used, not so much to describe the article clearly to customers, as to prevent confusion with some other article bearing the same number—as where a concern makes a "No. 3½ Hand Lathe," and a "No. 3½ Engine Lathe." There is no particular use in telling a customer that a thing is a hand lathe, unless he is told a lot more about it also. An advertisement, catalogue, letter or verbal description should, and often does, give reasonably full information. If it furthermore gives tor that particular article a short, easily written and spoken commercial name, such as "Lathe 4 8K," and if the customers know that the same symbol will never be used by that concern for any other kind of a lathe or for any other article, and if they know that they can get duplicate pieces for repairs by using simply "4 8K" with a number, etc., appended, then matters are considerably simplified as compared with the present *un-system*.

Some few years ago the writer found that the presses he was building needed re-numbering, as many new kinds and sizes (some of them intermediate) had been developed that had not been at first contemplated. Many numbers had been duplicated, and some fractions had crept in. Two sizes had been interpolated between the original "No. 2" and "No. 3," and several other kinds had been put in the market, numbered in series of 1, 2, 3, etc. The result was such actual names as "No. 2¾ Lever Foot Press," "No. 4½ Geared Power Drawing Press," and so on—the adjectives being needed because there were several other kinds with the same numbers. These "long-winded" titles had to be spoken in conversation, inscribed on circulars, letters, index and cost books, drawings, patterns, gauges, jigs, etc. He untangled this snarl for the time being by giving a separate number to each kind and size, and dropped the unnecessary word "number" as a prefix. These machines have since been known commercially as "Press 3," "Press 125," etc., the last figure representing the relative *size* of the machine, and the others (or the absence of them) the *type* and *kind*—all in a somewhat arbitrary way.

To some of the standardized kinds, the somewhat incomplete symbol system (as described in the former paper) was applied, and the patterns, etc., for Press 1 were marked "P P A"; for Press 3, "P P C," and so on. This simplified matters a good deal, but it left each press with two distinct names—one commercial, the other mechanical. This unnecessary and annoying duplication is now being remedied by the adoption of the system herein described, where the *article-symbol* used in the shop will, with the word *Press* prefixed, become its commercial name. For this change the present time is a fitting one, because the family of presses in question have again outgrown their numbers—from want of sufficiently careful foresight in assigning them.

A second modification among those referred to, provides that the *piece-symbol* should be a number, used as in the former paper, but always followed by a letter (as 15A, 17K, etc.), to show the "style" of the piece. When the piece is first made, it is "Style A," after the first alteration "Style B," and after another alteration "Style C," etc. This provides for only twenty-five alterations in any one piece, which is very nearly sure to be amply enough, as it is probable that the whole article will be so changed by the time any of its pieces have been altered this many times, as to need a new article-symbol, and be known by a somewhat different name in the market. This idea is briefly hinted at in the last paragraph of the former paper, but it was there recommended that the letter be used only for obsolete pieces. Such a plan works all right for marking the patterns, drawings, etc., of such pieces, but does not distinguish the pieces themselves if they have already gone into the market, where, of course, the letter would not be marked upon them. Thus a customer in ordering a new style of piece would use the identical symbol that he used for a former style, and would be getting a different thing with the same name. This is contrary to the great principle herein advocated, of never naming two things alike, and was carelessly recommended in the former paper through lack of sufficient thought. The faulty principle involved has been pointed out by Captain Metcalfe on page 109 of his interesting book, and the amendment is cheerfully accepted. It is, of course, objectionable to have to speak and write this additional letter every time a piece-symbol is used, but its adoption seems to be absolutely necessary in dealing with the very difficult problem of the alterations, which, perforce, are constantly occurring even in the best studied standard articles; especially is this the case with machines of all kinds. It may be here objected that if an article-symbol is retained after one or more of the pieces of that article have been altered, and their style changed, then the general law before referred to is broken, and a customer is not getting the identical article in all its details that he got before, under the same name. This is theoretically true, but it seems a lesser evil than would be incurred by changing the commercial name of, say, a lathe, made of 500 pieces, because one of its keys had been made a little shorter, or its spindle increased ½″ in diameter, or a lock-nut added somewhere. Practically the scheme here given works well enough, and a customer for a given name gets essentially the same article as before, although perhaps a little improved. When the improvements become very great, and many of the important pieces are so changed as to make an evident difference in design, then the whole article should simply be given a new symbol, allowing the old one to become obsolete forever. Before this is done, there is, of course, some danger of not getting exactly what is wanted when ordering duplicate pieces for repairs, but for this evil there are preventives. One is to let each piece have its piece-symbol cast or stamped upon it. This, if quoted, will enable the manufacturer to know by his records whether a similar new style piece can be substituted, or whether he must make an exact duplicate of the old style. Such marking is in most cases too expensive, but, if the pieces are not marked, all confusion can be avoided if the customer states the "shop-number" of the article in question, in which case the shop records will show just what alterations of style all the pieces have been subjected to at the time that individual article was sent out—it being understood that all articles are "shop-numbered" consecutively. Of course if pieces are not marked, the customer must have a reference sheet containing pictures of each piece, with their symbols attached.

It will be noticed that although, for excellent practical reasons, the writer would tolerate a little laxity regarding article-symbols, retaining them in some cases through slight and inconspicuous changes of design, he would invariably apply the sternest logic of the general law involved to all piece-symbols. This allows absolute identification in the factory of the real units of manufacture—the *pieces*. It is possible to imagine such conditions in some manufacturing business, that an article-symbol would be *sure* to be changed every time any piece was changed in the slightest degree. In such case, the final letter of the piece-symbol could be safely omitted, but in the writer's experience he has not found such a course to be advisable. Each concern must of course judge for itself regarding such details, but should follow the general principles herein set forth.

A third modification is in regard to another symbol, briefly referred to at the end of the former paper, used for piece *operations*. It is there given as first, second, etc., but the simple numbers 1, 2, 3, and so on, are shorter and just as good; when the symbols are properly written, so as not to be confused with each other. This symbol, in connection with the former ones mentioned, is very useful upon cost records, piece-work tables, drawings, special tools, etc. The numbers should be properly "gapped," so as to allow room for any interpolated operations not used at first. The writer has found it well in building machines to leave the first ten numbers for such operations as *buying* materials, *freighting* them to factory, *casting*, *cleaning*, *painting*, etc.—commencing with regular machine-shop operations at "11," and running upward. Now, calling the buying of material an "operation" may not be quite conventional, but it is strictly logical, and has proved very useful in simplifying the book-keeping of ascertaining total costs. This is because the initial value of the piece, before factory operations are commenced upon it, comes in the same table with all the subsequent items of cost (each represented by a numbered operation), and the simple addition of the columns then shows its terminal value, so to speak. Any operation (in machine work, for instance,) may be defined as: *that work upon a piece which is done by one person (together with his assistants, should heavy lifting, etc., be required) at one time—that is, before laying this piece aside and taking up another one.* This allows operations to be known by their symbols, and treated as definite components of value in piece-work, and in ascertaining costs and time generally. An "operation" need not necessarily consist of only one kind of work on a piece, but this depends greatly upon the kind of tools employed. Neither is it always the whole of what might seem to be one kind of work on that piece. In the first case, the drilling of a hole in a casting in an ordinary drill press *might be* an operation of itself, the piece being passed on to another machine with another operator, for the drilling of another different sized hole alongside of it, and to a third operator, perhaps, to tap or counterbore these holes. Or, it might be laid down until its fellows were done—and then have another operation done on it by the same man and machine afterwards, with a different drill. If, however, a special gang-drilling machine is used, with several drills and other boring and tapping tools, then the manipulation of several holes will become one operation; as is often seen in sewing machine building, where nearly all the machine work is done upon a frame-casting, when set in a proper jig, by one man, and in a time so short as scarcely to be measured in minutes. In the second case, drilling a single hole *might* become two operations, because it was too deep for the machine first used, and a subsequent operator would deepen it by other means.

Practical Drawing.

By J. G. A. Meyer.

SIXTY-THIRD PAPER.

508. To lay out in the boiler shop the diaphragm plates and netting shown in Fig. 389 (last paper), is a simpler matter than it appears to be in the foregoing illustrations. For instance, let us assume that we have received a drawing of a smoke-box, such as is shown in Fig. 389; it is required to lay out a wooden template to which the netting *D E* is to be cut.

Our first step will be to describe, full size, on the floor, a semi-circle whose diameter is equal to the inner diameter of the smoke-box, namely 50 inches, as shown in Fig. 390 *A* (page 3). Assume now that the netting is ¼ of an inch thick, then the distance between the upper surface of the netting *C H* and the top of the smoke-box (inside) will be 14⅝ inches. Therefore from the extremity N_1 of the diameter, Fig. 390 *A*, lay off on this diameter a point N_6; the distance between the points N_1 and N_6 must be equal to 14⅝ inches. Through the point N_6 draw a line $N_6\ M_6$ perpendicular to the diameter, and cutting the circumference in the point M_6. Divide the distance between the points N_1 and N_6 into five equal parts, and through the points of division N_2, N_3, N_4, N_5 draw lines parallel to $N_6\ M_6$, cutting the circumference in the points M_2, M_3, M_4, M_5, respectively.

Also draw full size, on the floor, a right-angled triangle *K D E*, whose side *K E* is equal to 15 inches, and the side *K D* equal to 14⅝ inches.

Let *O P Q R*, Fig. 389 *D*, represent a rectangular board on which the outline of the netting is to be laid off. Through the center of this board draw a straight line $l_1\ l_6$. On this line lay off two points l_1 and l_6, and make the distance between these points equal to the hypothenuse *E D* of the right-angle triangle. Divide the distance between the points l_1 and l_6 into five equal parts, and through the points of division l_2, l_3, l_4, l_5, and also through l_6, draw lines perpendicular to the center line $l_1\ l_6$. Now make $l_2\ m_2$ equal to $M_2\ N_2$ (Fig. 390 *A*); $l_3\ m_3$ equal to $M_3\ N_3$; $l_4\ m_4 = M_4\ N_4$; $l_5\ m_5 = M_5\ N_5$ and $l_6\ m_6 = M_6\ N_6$. Join the points $l_1\ m_2, m_3, m_4, m_5, m_6$, by a curve. In a similar manner find the curve $l_1\ m_7$ and cut the board to the curve $m_7\ l_1\ m_6$ and the straight line $m_7\ m_6$, which will complete the template.

The method for laying out the diaphragm plate *F G*, shown in Fig. 389, is just as simple as the foregoing. We describe full size the semi-circumference, as shown in Fig. 390 *A*, and also draw a line $D_6\ I_6$ perpendicular to the diameter; this line represents the bottom edge of plate; care must be taken to draw it at the correct distance below the

center D_3; we also draw above the center D_2 a line parallel to the line D_6 I_6, to represent the upper edge of the same diaphragm plate. If correctly drawn, according to the dimensions given in Fig. 389, these two edges in Fig. 390 *A* will be 24 inches apart. In Fig. 389 we notice that the distance between the upper edge of diaphragm plate *F G* and the flue sheet is 6 inches, and the distance between the lower edge and the flue sheet is 13½, giving us a difference of 7½ inches between these two distances. Hence to obtain the correct distance from *F* to *G* without measuring our small drawing (Fig. 389) we simply draw a right-angled triangle, one of whose sides is equal to 7½ inches, and the other side equal to 24 inches; the hypothenuse of this triangle (drawn full size) will be the distance between *F* and *G*. This distance, *F G*, gives us the correct width of the plate to be laid out; for finding the curved edges of this plate, an explanation is not necessary, as the method is similar to that shown in Fig. 389 *D*, and otherwise shown in Fig. 389 *B* (last paper).

509. Figs. 391 and 392 represent sections of a throttle valve for a marine beam engine, and Fig. 394 represents an end view of the same. This throttle valve consists of a cast-iron cylindrical casing *B*, bushed by a brass lining *C*; a fly valve *D* turning around the axis of the stem *E*; a brass gland *A*; and the valve stem cap *F*, also made of brass. The section shown in Fig. 391 is made by a cutting plane parallel to the vertical plane of projection, passed through the axis of the stem and also through the axis of the casing; the stem itself, according to the usual custom, is not cut by this plane, and therefore its exposed part is shown in full.

Fig. 392 represents a section made by a cutting plane, perpendicular to the axis of the valve stem and passed through the axis of the casing; this plane will of course, under these conditions, be parallel to the horizontal plane of projection. We may therefore name this last plane the horizontal cutting plane; and the former one the vertical cutting plane. Since the vertical cutting plane is parallel to the vertical plane of projection, and the horizontal plane is parallel to the horizontal plane of projection, they must be perpendicular to each other; and because both cutting planes pass through the axis of the casing, the center line x_2 x_2, Fig. 392, will be the horizontal trace or projection of the vertical cutting plane; and the center line x x, Fig. 391, will be the vertical trace or projection of the horizontal cutting plane. Here, then, we see that our cutting planes are represented by the lines x x and x_2 x_2; and for this reason draftsmen will often write under the view shown in Fig. 391, "section through the line x_2 x_2"; and under the view, Fig. 392, will write, "section through the line x x."

To make a working drawing of this throttle valve is an interesting, profitable and practical example, which again demands a knowledge of geometrical principles, and also indicates that the time spent in the study of the previous geometrical problems has been well spent, and has not been used simply for the attainment of an unnecessary refinement; indeed, it is absolutely necessary that the artisan should possess a knowledge of geometry, which is just as useful to him in the solution of practical problems, as it is to the students who intend to obtain a thorough knowledge of the higher branches of mathematics.

No difficulties should be encountered in making the end view as shown in Fig. 394, or in making the section as shown in Fig. 392; these are simply plain projections of elementary objects, and the manner of making projections of this kind, we believe, has been sufficiently explained in connection with the numerous examples previously given. We shall therefore assume that these two views have been drawn on the paper.

Now, referring to Fig. 392, we see that when the valve *D* is closed, its center line *w* *w* forms an angle of 15 degrees with the center line *y* *y*, and the peripheries of both the flat surfaces which are represented by the lines f_5 f_6 and g g_2 must be in contact with the inner cylindrical surface of the lining *C*.

In Fig. 394 we see the true form of the casing, but we do not see the true form of the valve *D*, because this valve is shown foreshortened in the direction of the center line x x. Here then the question arises, How can we determine the true form of the fly valve *D*?

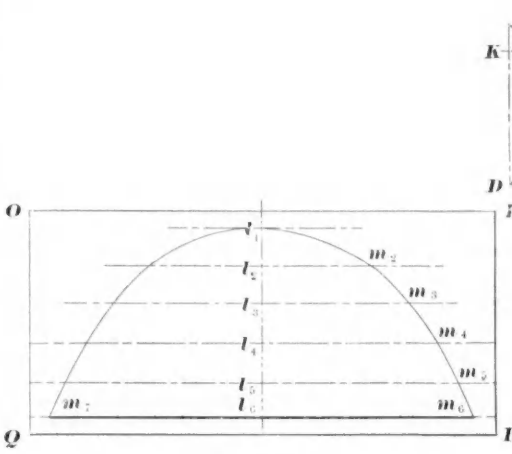


Fig. 389 D

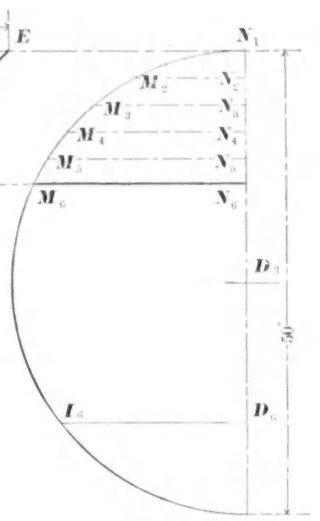


Fig. 390 A

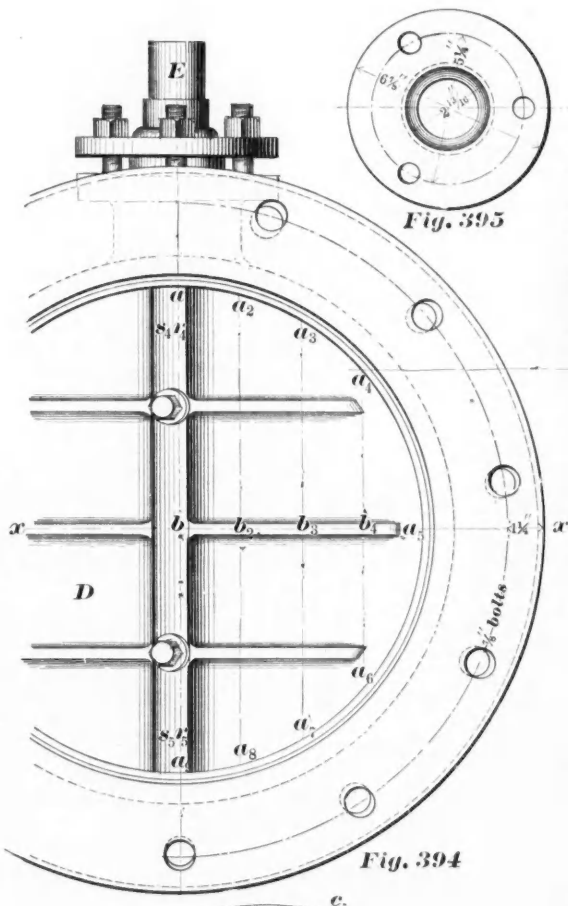


Fig. 394

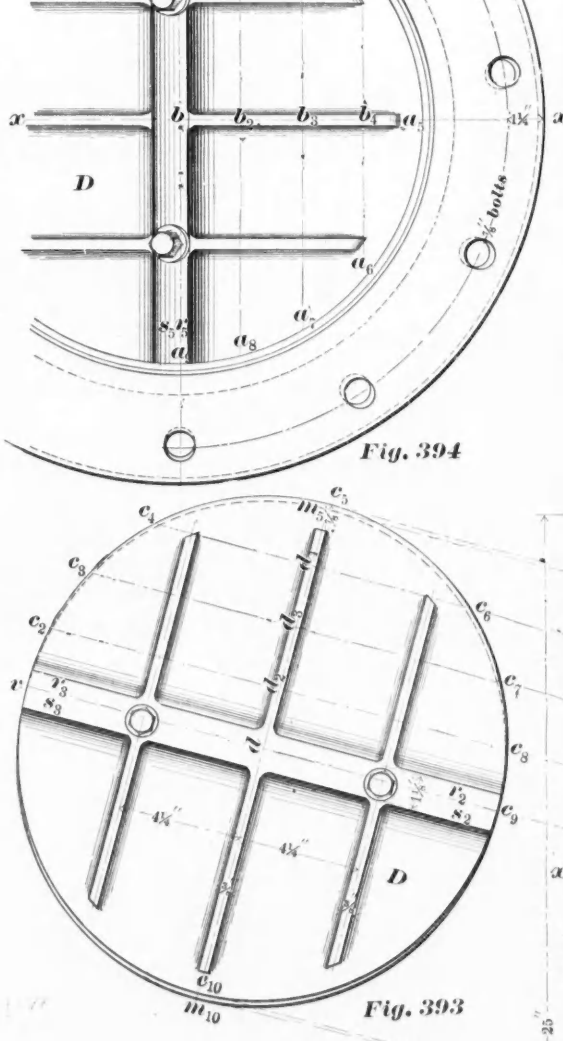


Fig. 393

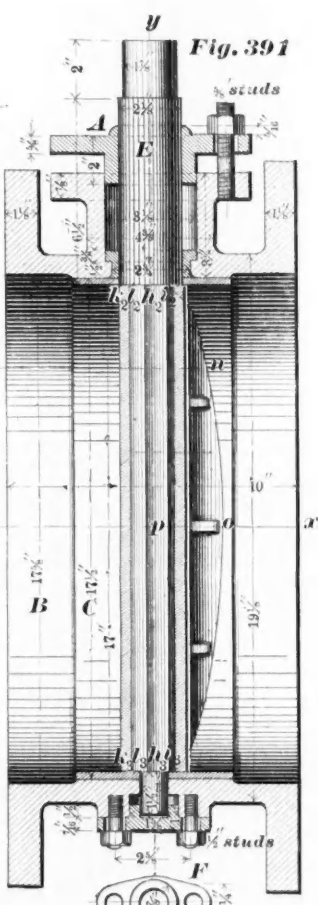


Fig. 391

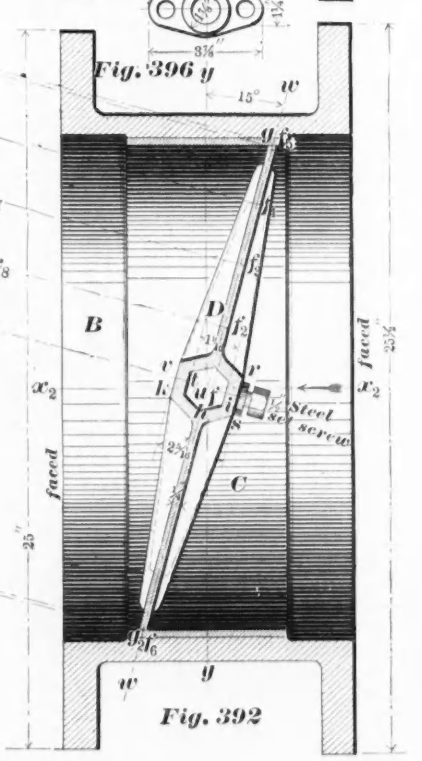


Fig. 392

The true form of the valve *D* is shown in Fig. 393, and is found in the following manner:

Fig. 394. Divide the radius b a_5 of the inner circle (the circumference of this circle represents inner surface of the lining, and also represents the periphery of the valve *D*) into any number of equal parts, say four, and thus obtain the points of division b_2, b_3, b_4; through these points draw vertical lines cutting the circumference of this circle in the points a_2, a_3, a_4, a_6, a_7, a_8; also through the center b draw the diameter a a_9.

Fig. 392. Prolong the line f_5 f_6 so as to cut the center line x_2 x_2 in the point f; divide the line f f_5 into as many equal parts as have been spaced off on the radius b a_5 (Fig. 394); that is to say, divide the line f f_5 into four equal parts and thus obtain the points of division f_2, f_3, f_4. Through the points f, f_2, f_3, f_4, f_5 draw the lines f c, f_2 c_2, etc., perpendicular to the line f f_5.

Fig. 393. At any convenient distance from the line f_5 f_6 draw a line c_5 c_{10} parallel to f_5 f_6, cutting the lines drawn through the points f, f_2, etc., in the points d, d_2, d_3, d_4, and d_5. From the point d as a center and with a radius equal to b a (Fig. 394), describe two short arcs cutting the line c c_9 in the points c and c_9; from the point d_2 as a center and with a radius equal to b_2 a_2 (Fig. 394), describe two short arcs cutting the line c_2 c_8 in the points c_2 and c_8; in a similar manner make the line c_3 c_7 equal to a_3 a_7; and c_4 c_6 equal to a_4 a_6. Join the points c, c_2, c_3, c_4, c_5, c_6, etc., by a curve. This curve will be a semi-ellipse, and is the boundary of one-half the surface represented by the line f_5 f_6 in Fig. 392. The semi-ellipse c, c_{10} c_9 is found in a manner precisely similar to the foregoing.

The line c_5 c_{10} will be the major axis, and the line c c_9 will be the minor axis of the ellipse just found.

It will be well to notice that the minor axis c c_9 does not coincide with the axis of the stem, which, for the sake of simplicity, has not been shown in Fig. 393. But this fact is made evident by remembering that the point u, in which the center line x_2 x_2 (Fig. 392), and the center line y y intersect each other, represents the axis of the valve stem in this particular view. If we now draw through the point u a line perpendicular to the center line w w, or the line f_5 f_6, which amounts to the same thing, then this line will fall below, and be parallel to the line c c_9, and the portion of this line limited by the periphery of the ellipse (Fig. 393) will represent the axis of the stem in this view.

Hence we conclude that the minor axis in Fig. 393 must be above the axis of the stem.

The boundary curve of the surface represented by the line g g_2 in Fig. 392 is represented in Fig. 393 by the curve m_5 c_9 m_{10} c, which is also an ellipse, and furthermore, it is exactly equal to the ellipse c_5 c_9 c_{10} c, previously found, but these two curves do not coincide with each other.

To find the correct position of the ellipse m_5 c_9 m_{10} c, and also practical hints, will be given in our next paper.

To encourage the development of the coal-mining industry, the Legislative Assembly of the Argentine Republic has approved a proposal made by a private company, by which the Government guarantees to the company undertaking to work the coal mines of Rioja an interest of 5 per cent. on the capital invested for fifteen years; the company to invest a capital of 2,000,000 dollars, the guarantee of the Government to begin from the day that the railway connection is established, or from the day when actual work begins in the mines.

Notes on the Expansion of Steam.

By RICHARD H. BUEL.

THIRTEENTH PAPER.

The effect of attaching a condenser to a non-condensing engine is to decrease the back pressure. Assuming that the back pressure is reduced to 1¾ pounds per square inch, and that the friction pressure and pressure required to operate the air pump of the condenser amount to 2¾ pounds per square inch of effective piston area, the total back pressure will be 4½ pounds per square inch, instead of 17½, as in the case of the non-condensing engines, already considered. But since the temperature to which the internal surfaces of the cylinder are subjected at each stroke is lowered by the use of a condenser, the hourly condensation on these internal surfaces is usually increased; and in the present discussion it is assumed that each square foot of internal surface condenses 25 pounds of steam hourly, instead of 15, as before.

By making these two changes in the assumptions, the general formulas published in the AMERICAN MACHINIST for June 30, 1888, become available for condensing engines. The results calculated from the formulas are given in Table *G*, each line containing a reference number to the formula used.

It will be seen, by comparing the figures in line 57 with the figures in the same line for non-condensing engines, that the economy at points of short cut off is greatly increased, principally on account of the reduction in back pressure, the modifying effect of which was discussed in the first article of this series. Of course, this reduction in back pressure increases the effective horse-power to a considerable extent, over the corresponding cases for non-condensing engines, the increase being especially marked at the shortest cut-offs. It may be a question in the minds of some readers, whether as much economy would be shown over the non-condensing engines if the same effective horse-power were developed in each instance. This can readily be determined by calculating the results under the last supposition. Table *H* contains the calculation, in an abbreviated form, from the formulas of the general table, with references in each instance to those formulas; all necessary data for the solution being supplied, but some of the intermediate steps being omitted. By the aid of the formulas published June 30, 1888, the reader can follow the calculations in Table *H*, and can easily supply the intermediate steps of the problem.

It will be seen that the economical results, line 57, Tables *G* and *H*, do not differ greatly, for similar points of cut-off; and it may be interesting to check the theories and assumptions introduced into the calculations by an examination of some practical results. Table *I* is compiled from the record of experiments made with an automatic cut-off engine, measuring the effective horse-power on a friction brake; and a comparison of the figures in the last column of this table with corresponding figures in line 57, Tables *G* and *H*, indicates that the assumptions agree fairly with good practice.

H.—Theoretical Results of Using Steam Expansively, Condensing Engines, Dry Saturated Steam, Unjacketed Cylinders, 150 Effective Horse-Power, 100 Pounds Initial Pressure, 4½ Pounds Back Pressure.

ITEM.		SYMBOL.	FORMULA.	POINT OF CUT-OFF. Full str'ke	¾	½	1-3	¼	1-6	⅛	1-12
Trial data.	Mean effective pressure	T	13	90.5	88	77.7	64.1	54.5	41.8	34	24.8
	Cross section of cylinder, square inches	a	15	121 55	125	141.57	171.61	201.84	263.16	323.53	443.55
	Diameter of cylinder, inches, to nearest ¼"	d	16	12½	12½	13½	14¾	16	18¾	20¼	23¾
	Stroke, inches	s	17	25	25	27	29½	32	36½	40½	47½
	Fraction of clearance	F	18	.0·75	.0400	.0394	.0381	.0311	.0355	.0340	.0355
Per cent. of clearance to nearest ¼"		c	19	3¾	4	4	3¾	3¾	3½	3½	3½
Real ratio of expansion and ratio of compression		R. l	20, 24	1	1.3165	1.9259	2.7978	3.6087	5.1322	6.4687	8.7465
Hyperbolic logarithm of preceding		l by log R	From tabl's	——	.2753	.6554	1.0289	1.2834	1.6355	1.867	2.1686
Probable mean effective pressure		e	30	85.6	83.4	73.6	61.4	52.7	41.2	34.4	25.8
Diameter of cylinder, inches, to nearest ¼"		D	34	13	13¼	14	15¼	16½	18½	20¼	23½
Stroke, inches		S	35	26	26½	28	30½	33	37	40½	47
Diameter of piston rod, inches, to nearest 1-16"		p	36	2 5-16	2⅜	2½	2¾	3	3 5-16	3⅝	4¼
Cross-section of cylinder, square inches	Actual	(A)	37	122.73	127.89	153.94	182.65	213.83	268.8	322.06	433.74
	Effective	(q)	38	130.63	135.67	151.48	179.68	210.29	264.49	316.9	426.64
Probable effective horse-power		(E)	39	152 5	154.3	152	150 4	151.1	148.6	148.7	150 1
Volume, cubic feet.	Cylinder and clearance, up to 95-100 stroke	v	42	1.941	2.06	2.43	3.132	3.966	5.578	7.316	11.309
	Clearance	N	41	.0737	.0832	.0982	119	151	.198	.26	.402
Absolute pressures.	Final cushion	L	27	4.5	5.9	8.7	12.6	16.2	23 1	29.1	39.4
	At 95-100 stroke	B	44	91	73.8	51.8	36.2	28.4	20 1	16	11.9
Number of strokes per hour		w	43	12752	12226	11571	10623	9818	8759	8000	6968
Weight of steam per cubic foot, pounds	At pressure L	w	From tabl's	.01239	.0161	.02319	.0328·5	.04159	.05805	.07211	.09586
	At pressure B	W		.2107	.174	.124	.0863	.07048	05093	.04111	.03113
Pounds of steam hourly, calculated by piston displacement		Q	47	5203	4330	3460	2821	2683	2387	2256	2185
Latent heat per pound of steam at pressure *B*. British thermal units		(l)	From tabl's	——	899	916	931	941	955	963	973
Pounds of steam condensed hourly for work of expansion		(C)	52	——	106	194	249	281	313	339	390
Thickness of piston, inches, to nearest ½"		(T)	53	3½	3½	3½	4	4	4½	4½	5
Internal condensing surface, square feet		(a)	54	16.3	16.9	18.8	22.4	25.8	32.8	39.1	52.1
Probable condensation, hourly, on internal surfaces, pounds		(d)	25x(a)	408	424	471	561	645	819	976	1304
Probable consumption of steam, hourly, pounds.	Total	(w)	56	5611	4860	4125	3631	3609	3519	3571	3879
	Per effective horse power	(W)	57	36.8	31 5	27.1	24.1	23.9	23.7	24	25.8

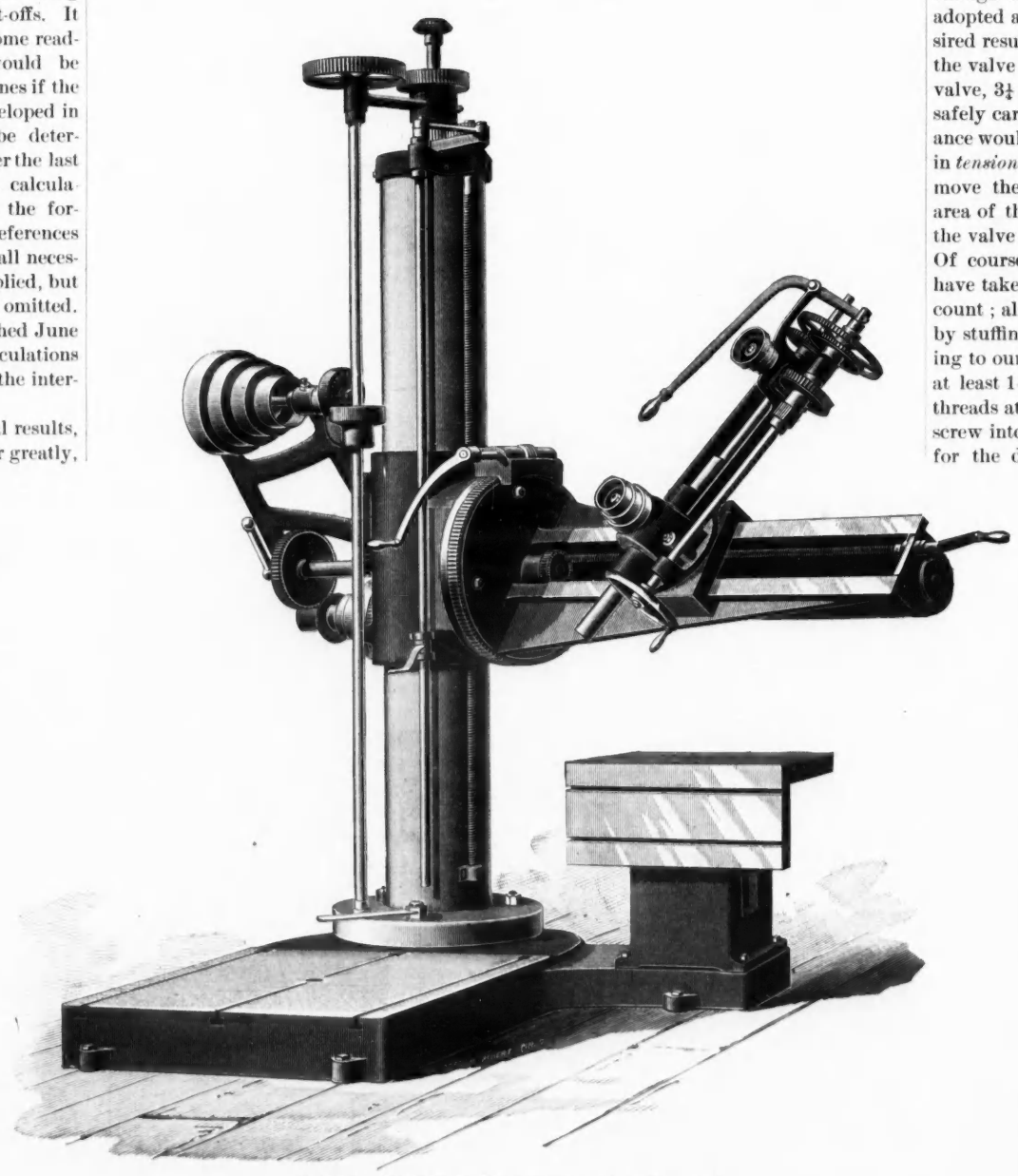
Design, Construction, Repairs, and Management of Marine Steam Engines and Boilers.

By W. H. HOFFMAN.

EIGHTEENTH PAPER.

The receiver between the high-pressure and intermediate-pressure cylinders, and the one between the intermediate-pressure and low-pressure cylinders, will be cylindrical copper tubes, riveted to bronze flanges, these being attached to the steam and exhaust belts on the several chests. The tube condensing the high and intermediate-pressure chests will be 12½" in diameter, and will, with the capacity of the intermediate chest, give us $\frac{6}{10}$ the capacity of the high-pressure cylinder.

The tube connecting the intermediate and low-pressure chests will be 16" in diameter, and will, with the capacity of the low-pressure chest, give us $\frac{67}{100}$ the capacity of the intermediate cylinder. The flange joints on each of the tubes will be the ball or spherical type, and all flanges will be held in position (clasping the swivel-ring) by eight swinging bolts on the 12½" tube, and twelve bolts on the 16" tube. These ball or spherical rings will be sectional, and the sections will be tongued and ground together, and the laps will be long and wide. These rings will be made of the best phosphor bronze. The copper tubes will be filled with three light wrought-iron rings, bolted together in halves, to which will be fastened the wooden lagging.



RADIAL DRILLING MACHINES.—SEE PAGE 5.

By this arrangement of receivers, we avoid the large extension of the cylinder bodies, and construct a receiver (when repairs are necessary) that does not call for the removal of all of the cylinder lagging.

The lower bonnets for the valve chests will each have a water-pocket 4" deep, below the end of the chests, and the water of condensation will be conducted from these pockets to the common well, designed for collecting condensation from all parts of the engine.

As we propose to adopt in our design a tight, and yet well-balanced piston valve, we shall not require large valve stems, but will endeavor not to make a common mistake, and get them too small. The three stems will be of the same size in diameter, and of the same length. Of course the stem for the high-pressure chest will appear to be large; the one for the intermediate chest will be about right as to size, while the one for the low-pressure chest will appear to be too small, because all of them will be proportioned for the intermediate chest; but all will be sufficiently strong for the work they have to perform. The weight of the valves, their stems, the plunger-guides, with their links, pins, and other attachments, will be perfectly balanced by the steam balancing pistons attached to the top ends of the valve stems. Under these conditions, the compressive strains on the valve stems will be only those caused by the friction of the reciprocating parts. The intermediate-pressure valve will at no time have a load due to frictional resistance of more than 1,200 lbs., and this load will be traveling at about 80 ft. per minute. The 1,200 lb. load on this valve is due to its peculiar construction, and the pressure is equally distributed. The load on all of the valves is automatically adjusted by the steam pressure.

In order to make a valve stem strong enough on high-speed engines, the writer has adopted a rule that has always given the desired results. Make the threaded portion of the valve stem, where it connects with the valve, 3½ times the sectional area necessary to safely carry the load. The 1,200 lbs. resistance would require a $\frac{11}{16}$ rod to safely transmit in *tension* this load, and a 1" rod would safely move the load in *compression*, so that the area of the stem at the threaded portion in the valve should be at least $2\frac{7}{10}$ square inches. Of course, in arriving at these figures, we have taken the length of the stem into account; also the points at which it is supported by stuffing-boxes and other guides. According to our rule, we must have a diameter of at least $1\frac{11}{16}$" at the bottom of the valve stem threads at the valves, and $1\frac{15}{16}$" where they screw into the plunger-guide, and, allowing for the depth of the threads, the bodies of our valve stems will be $2\frac{3}{16}$" in diameter. These stems will be made of the best hammered open-hearth steel, and they will be ground on centers, after coming from the finishing tool of the lathe. The lower ends of these stems will have a thread 11" long, cut 6 threads per inch, for the vertical adjustment of the valves' stems and valves, two deep check nuts with a vise guard being fitted to the stem. The top ends will be shouldered and threaded, to receive the balanced piston.

The threads holding the two sections of the piston valves will be 1⅞", and 2⅛" in diameter, and 12" long. On these threads will be fitted four bronze check nuts, these nuts being tapped for ¾" steel set screws; this being necessary in order to prevent the main nuts from starting loose when the engines are under high speed.

The stuffing-boxes on the lower chests' bonnets will be 3½" in diameter inside, and will allow for a depth of metallic packing of 4¾", while a screw gland of the same type as those on the main stuffing-boxes will keep the packing in position. Ordinary fibrous packing can also be used.

The worms and shafts for working these stuffing-box glands will be operated from be-

low, by a long ratchet and pawl lever, fitted with a square socket to the worm shafts. The ratchet lever will always be removed after setting up the glands, thus leaving the engine platforms free from projecting obstructions.

We often see in modern ships the platforms so hampered by cylinder cock levers, stuffing-box rods, and wheels, throttle levers for the main and auxiliary engines, reversing levers or wheels, and many other necessary details, that it is almost impossible for the engineers on watch in heavy weather to move about the platforms without risk to life and limb, and they are always in the way, and are liable to be broken when repairs are in order.

The balancing pistons on the valve stems will be fitted to the stems on a steep taper, so that the piston can be removed by hand instantly if necessary. These pistons will be fitted with rings of a square section, sprung into place. The plunger-guide cylinders will be bolted to the lower side of the brackets that support them, with two $\frac{7}{8}$" swinging bolts, so that in case of accident to the plungers, stems, or cylinders, the cylinders can be pulled off from the guides without the brackets or any of their attachments, and when the plungers require repacking, the cylinders will be removed in the same manner.

There is another matter that may be spoken of here, and that is the arrangement and connections of the drain and cold water bath pipes. The general practice is to run these pipes in rather a loose and unmechanical manner around the outsides of the cylinder laggings and the upright frames, and in the next paper I will describe a substantial method of putting up these important details.

Radial Drilling Machines.

We illustrate herewith two forms of radial drills built by the Universal Radial Drill Co., of Cincinnati, Ohio.

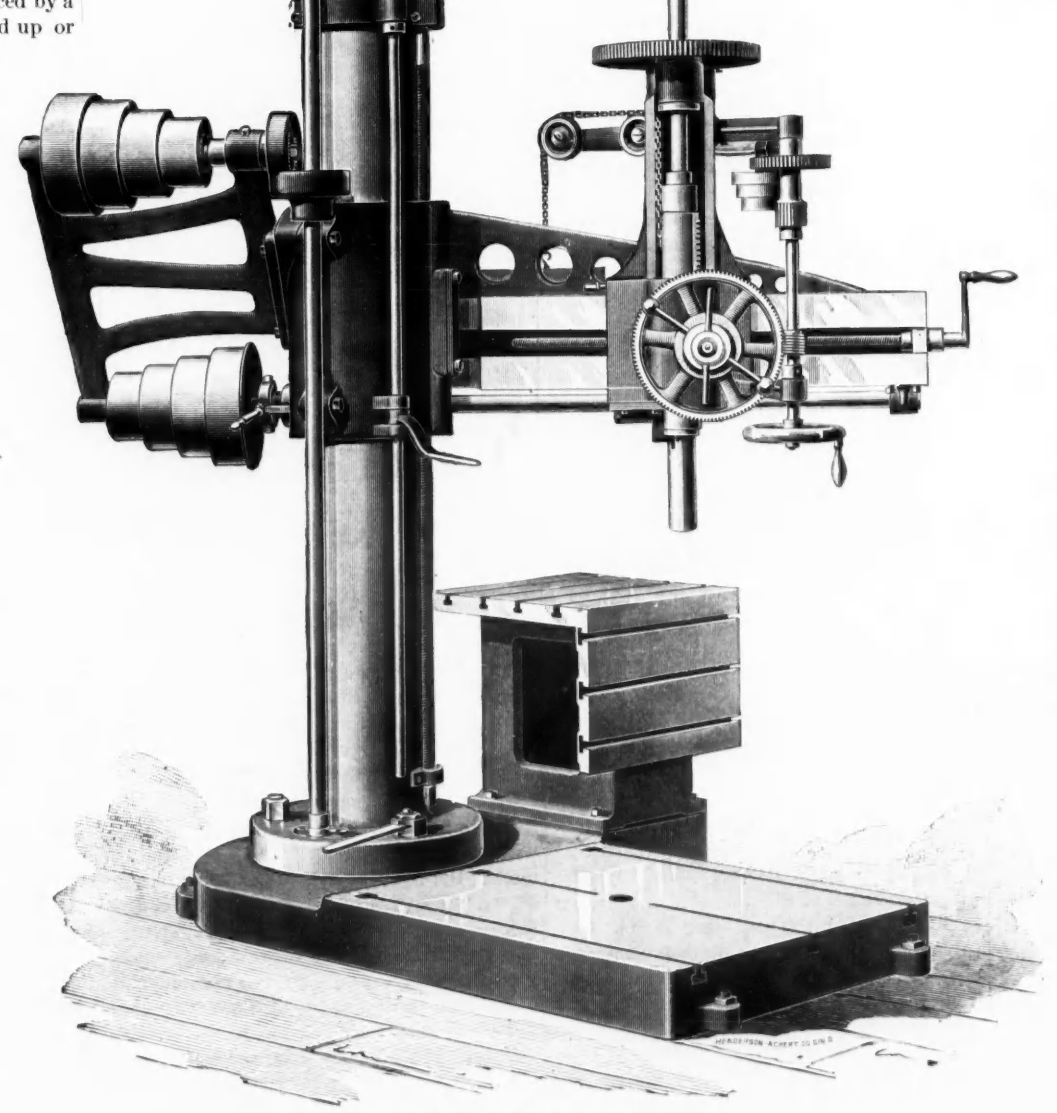
The one shown on this page is a plain radial drill, having automatic power feed and quick return for the spindle, which is balanced by a weight, as shown. The arm is moved up or down the column by power, and the machine is back-geared, the gears being inside the lower cone pulley, and shifted by a single movement of the lever shown at the end of that pulley. The change from direct to back-geared motion can be made at any time without stopping the machines. Motion is received from a horizontal shaft carrying a miter gear, which drives the miter shown on the shaft at the top of the column, the cut showing clearly how the motion is transmitted from that point. The vertical shaft, to which the miter gear is attached, is made sufficiently long to accommodate ceilings 15 feet high. The column is bored and fitted over a stationary stump, which is bolted fast to the sole plate. This stump has sufficient length of bearing to prevent the column from swaying, and is provided with an adjustable pivot, bearing upon an elastic diaphragm in the column, which, when the bolts in the flange at the lower end of the column are slackened, takes the weight of the column, arm, etc., off the flange bearing, allowing it to revolve easily the entire circle. For ordinary drilling the bolts in flange need not be tightened, but when extra rigidity is required a partial turn of the wrench will bind the column fast to the sole plate.

The one shown on page 4 is a universal radial drill, the general design and construction of which is the same as above except that the arm is made to swivel, and by means of the worm engaging with teeth cut on the edge of the flange, can be revolved entirely round and clamped rigidly in any desired position. The spindle frame also swivels, these two adjustments making it possible to drill holes at any angle, and vertical or horizontal lines of holes at any desired angle, but parallel with each other. On this machine there is a new method of operating the quick return of the spindle. The feed shaft on the head is hollow at the top, and carries a rod within it, operating a lug clutch, this rod being operated by means of the bent lever shown in the illustration. By shifting this lever the clutch is thrown into connection with the large gear at the top of the head, which operates the quick return, and drives in the ratio of three to one, or, it may be thrown into connection with the straight feed gear underneath the large gears, in which latter instance the hand-feed is available, or, by adjusting the knurled friction disk which is at the lower end of this shaft, power feed is obtained.

In both machines the arms are strongly ribbed, and the tables have both vertical and horizontal surfaces provided with T slots. All gears are cut, and the bevels and miter wheels in arm and spindle frame are of cast-steel, cut. The spindles, feed-screws, and elevating screws are of machinery steel, and feed worms of cast-steel, hardened.

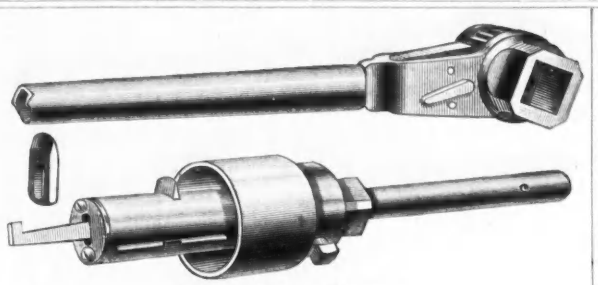
All thrust bearings are provided with phosphor bronze washers. Countershafts accompany each machine, consisting of a frame with horizontal shaft, carrying miter gear, tight and loose pulleys.

Various sizes are built, regarding which full particulars may be obtained by addressing the makers, as above.



RADIAL DRILLING MACHINES.

A street car motor run with gas from crude petroleum is on exhibition at Chicago.



ODGERS' FLUE CUTTER.

Odgers' Flue Cutter.

Our illustration shows a new flue cutter, which possesses some points of interest.

As will be seen, the tool consists of a cylindrical body, to which is fitted a recessed collar which is adjustable and held in place by a set screw.

This collar can be set at any desired distance from the edge of the cutter, and, bearing against the flue-sheet, forms a gauge and fixes the point at which the flue shall be cut, which may be either inside the flue-sheet, as in removing old flues, or outside, as in cutting to the proper length for beading. This collar, though shown concentric in the engraving, is really eccentric, the widest space being on the side where the edge of the cutter projects, so that when the collar is advanced so as to cover the cutter, as would be the case in cutting off a flue outside the flue-sheet, there will be room for the cutter to move outwards.

The outer end of the cylinder or stock is squared to receive a wrench, by which it is turned, and through the center longitudinally is a hole, which, part of the way through, is round, and the rest of the way, rectangular. In the hole is placed the feed bar, the outer end of which is round, and the inner end flattened and formed into a wedge with a hook on the end, as seen projecting at the left. The cutter is shown detached, and consists simply of a rectangular piece of steel, sharpened and provided with a rectangular slot, and fitted into a transverse slot in the cylinder. The wedge-shaped end of the feed bar passes through the slot in the cutter, and as it is driven in by a hammer, forces the cutter out and into the flue. The hook formed on the end of the feed bar prevents it being accidentally withdrawn beyond the cutter.

Provision is made for withdrawing it, by drilling a hole through the round part of the bar into which a pin can be put, against which the hammer can be used. At two points in the cylinder, small anti-friction rollers are put into cylindrical recesses, and held in place by the cap shown at the end fastened in place by screws. These rollers bear against the inside of the flue at two points, and reduce the friction and wear to the minimum.

Any kind of wrench can be used, and it can be turned in either direction.

A cut of a special ratchet wrench is shown, which can be used with it, and enables it to be used within a very limited space.

It is the invention of Mr. G. W. Odgers, Union st. and Westfield av., Elizabeth, N. J.

Shop Notes.

BY JARNO.

No. 12.

The difference between the details of the business methods of two men, one being successful and the other failing, may not be great. This was specially called to mind by the single item of sharpening lathe tools. After grinding, one man stoned his tools with a fine oil stone, while the other man's tools were put into the lathe directly from the grindstone. The man that stoned his tools was the more successful, because they lasted longer and did better work than those that were not stoned.

It will be remembered that a short time since we referred to the claim which had been made by some of the newspapers, that a locomotive had been built at Altoona, Pa., in sixteen hours. Of course, the claim that any such thing was done is simply preposterous, and results from a lack of knowledge, upon the part of those making the claim, of the difference between building a machine, and doing the comparatively few finishing strokes necessary to put the main parts together.

The *Railroad Gazette* published cuts showing the different stages of the work during its progress, and claimed the engine was *erected* in 16 hours and 50 minutes.

The cuts plainly showed that the engine was not erected, in the commonly understood sense of the term, within the time specified, because most of the work usually understood to be included in the work of erecting had been done previously. *Engineering*, in commenting on the matter, says:

> If the authors of this sensational incident in locomotive construction should be desirous of providing opportunity for a still more sensational paragraph, we might venture to suggest to them the possibility of further completing the erection of the engine in the frame shop, leaving for the "erecting" stage only that which may be called the final "face washing" and "hair brushing" of the completed locomotive. By this means opportunity would be afforded for the startling announcement: "The erection of a locomotive in the phenomenally short time of one minute!"

Petroleum as Fuel.

A correspondent of the *Electrical World* writes as follows:

The Detroit Steel Spring Works, of this

city, have used petroleum for eighteen months under eight boilers of 95 h. p. each, as well as in their furnaces for heating steel. The following figures refer only to the boilers, six being used at a time. They burned 24 tons of the best bituminous coal every 24 hours, and were often short of steam. The coal cost $2.80 per ton, and the labor, including removal of ashes, made the total expenditure per day (twenty-four hours) $80.25. The consumption of petroleum for the same period of time is 76 barrels of 42 gallons each, at a cost of 55 cents per barrel, the total cost, including labor, being $45.30 per day (twenty-four hours), a saving of $34.90, equal to 41 per cent. They have an abundance of steam, and always under a constant pressure. The arrangement of the furnaces was designed by H. Barr, the superintendent of the works. The result obtained in the heating furnaces has been equally satisfactory. I notice that a patent was issued to Mr. Barr on the 2d inst., on his method of arranging furnaces for burning crude petroleum.

LETTERS FROM PRACTICAL MEN.

Fitting Wrist Pins.

Editor American Machinist:

In your issue of October 27, 1888, I notice, among the Letters from Practical Men, that over the signature of B. Crank there is a communication discussing the methods of fitting wrist pins for steam engines. About two years ago I described a method that I have used several years, and with success in every instance. The operation is simple and perfect. I first rough-turn the main shaft and crank or crank disk, then shrink or press the crank or disk onto the shaft, and key it firmly in its position. I then place the shaft, and its crank or disk, in the centers of a *stiff* lathe, fitted with a boring attachment that is bolted to the head of the lathe, the boring bar of this attachment having a taper cutter and adjustment fitted to the front end of it. The boring bar has a transverse movement to and from the center of the lathe, to suit the various strokes, and in a regular steam engine shop two lathes should be fitted up, one having a swing of 28″ and a length of bed of 12′, and the other a swing of 68″ and with a length of bed of about 22.′

After the shaft is firmly placed in the centers of the lathe, the finishing cuts are taken on the shaft and the crank or disk, and the final motion is to lock the lathe face-plate (which has a radial slot in it for the stroke adjustment of the bar), bring the boring bar into position, and bore and then *grind* the crank-pin hole, either straight or taper, according to the design. The crank-pin is turned and ground to fit.

The method here described was used by the locomotive engine builders for boring the crank-pin holes in locomotive driving-wheels, nearly twenty years ago, some of the earliest being designed and built by the writer, but the special quartering machine is now in general use for this purpose. With a good lathe, the old bar attachment is always sure.

W. H. HOFFMAN.

108 Liberty St., New York.

Core Making in Foundries.

Editor American Machinist:

Very much time is spent in making cores in some foundries, and as time is money very much can be saved by making cores in whole boxes, instead of in half boxes, and then pasting them together.

In our shop we are doing a great deal of pipe work for house drainage and gas company work, and as a result we have a good deal of core making. We have lessened the cost of making cores in this way: We make a half dry sand core and then make a green sand core, and turn it out on the dry sand half, thus making a half dry and half green sand core. This can be done in making short pieces of pipes and branch tees, and small quarter turns, where the points are long enough to balance the core without using chaplets.

From a long experience in foundry work, I am of the opinion that all chaplets used should be tinned before using; if not, they are apt to be loose in the casting, unless the casting is one inch or more thick. In most foundries, flour is used for core making, but cores can be made from a compound composed of equal parts of powdered fire clay, rosin and flour. This compound makes a better core, and at a less cost than flour alone, and does not make such a smoke in the foundry. But every foundry is not supplied with a mill for grinding its own compound; but this compound can be bought from foundry supply men, and is a good thing to keep cores from blowing. I give this information for the benefit of small foundries that do not have the knowledge of core making. Many improvements can be made in core making, but as it is what is called a side issue in foundries, it does not receive much attention.

A foundry doing steam fittings or valves can save money by paying attention to their cores. The way we happened to try the half dry and half green sand core was we had more cores to make than our oven would dry, and as a result tried the new method with much success, and are using that style of a core in sleeves 2 feet long and 8 inches in diameter. We put iron rods in the green sand part as well as in the dry sand part.

Valatie, N. Y. DAVID SPENCE,
Supt. Sagamore M'f'g Co.

Don't Believe the Elephant Story.

Editor American Machinist:

I clipped the following from one of the large daily papers, and thought it might be of interest:

A car containing several elephants was run alongside a locomotive at Chestertown, Md., one day last week. One of the elephants put his trunk out through a crevice in the car, reached over to the tender of the locomotive, lifted the lid of the water tank, and helped himself. The other six elephants did the same, and in a short time the tank was dry. The train hands did not see the performance, and only when the engineer tried to start his engine did he find that the water was gone.

I find by measurement that the trunks of these elephants must have been over eleven feet long to accomplish the remarkable feat referred to. But the most heart-rending part of it was that the theft was not discovered until the engineer "tried" to start his engine. What if the elephant had taken the manhole cover off the boiler, and sucked the water out of that; or suppose he had pulled out the piston rods and packed them away in his trunk! But the elephant, after all, did the easiest thing, and the thing which any attempt at mechanical explanation usually does, viz., "sucked in" a newspaper reporter. STERLING ELLIOTT.

Globe Valves.

BY F. W. BARROWS.

THIRD PAPER.

We now come to the second class of globe valve patterns. In this class will be included iron or brass valves, from six inches down to two inches, and as much smaller as you wish to make, flanged valves. (See Fig. 106.)

The patterns should be solid, if of wood, with flanges for yoke and pipe ends put on, as shown in Fig. 104. These flanges, projecting as they do, above the general surface of the pattern, are thereby exposed more directly to the disintegrating influences arising from direct contact with shovel-handles, rammer-heads, moulders, etc., and so wear out faster than other parts of the pattern. If they are made separate from the body of the pattern they may be replaced without the expense of making a complete pattern. We may also substitute others of different size or shape, as may be required, thus enabling us to make a valve with circular flanges to match cast-iron pipe, or a valve to be tapped out for wrought-iron pipe.

I would like to have someone give me a good reason for making large valves with hexagon ends, when they are tapped for wrought-iron pipe. "Why," you say, "anybody can see what that is for, it's so that the piper can get hold of it with a wrench to screw it onto the pipe." Certainly, but how does the poor piper manage to screw the pipe into the other end of the valve? The pipe isn't squared, neither are tees, ells, wyes or couplings. My opinion of the squared ends for large valves is this: they are simply the result of habit.

We should gauge the length of prints for the pipe ends by the valve for cast-iron pipe, as that is usually longer than the one made for wrought-iron pipe. You will see that the print on yoke end is made tapering; the reason for this will be given when we come to make the core-box.

And now about the actual work on this pattern. Some pattern makers will think that there is nothing special to look out for, until the pattern is in the lathe and nearly down to size. I say down, because this man will surely have lots of wood to whittle off. This man deserves praise for one thing: caution in turning his pattern, as to dimensions. Never mind if he is up to his knees in chips ($65.00 per M.), and has thin slivers left on the surface of the pattern where the size didn't quite come down to the joints. Never mind if his glued joints are gaping open, and the outside of the pattern looks as if the lumber in it had been selected with a view to its beauty for cabinet work rather than for its durability as a pattern. This man's employer is to be congratulated for one thing, that the pattern maker didn't turn up his pattern with the same kind of haste that he glued it up in.

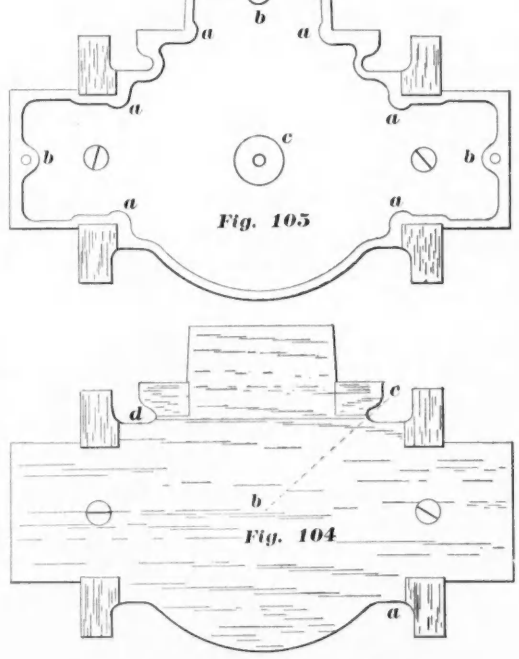


Fig. 105

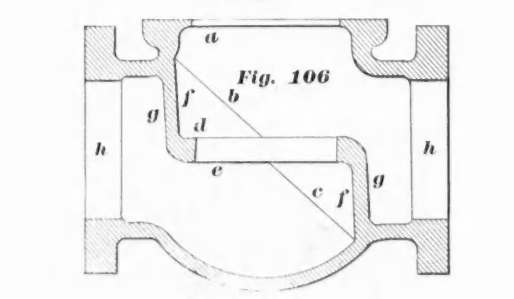


Fig. 104

Fig. 106

GLOBE VALVES.

There is another man who will rush at a job as if he had resolved that it must be done, and done immediately. This man often gets out a lot of stuff and then sees a better way of building his pattern, and so he gets out a second lot of lumber, and consoles himself with the thought that, after all, there won't be much wasted, because it will be used up for something, and as his mind will be so filled with the new idea (and possibly a little remorse), there is very apt to be spots on his second piece that don't finish. Of course there is nothing that could have been foreseen and avoided, and a little beeswax will make it all right, anyway. This man's employer is to be pitied because it takes his pattern maker so long to finish a job.

There is another class of pattern makers who seem determined to make the present job hold out until they get another one, if they die in the attempt. This order of mechanics is not confined to the trade of pattern making; they are quite common in other trades. Their work is usually well done, and correct in dimensions. Where the rusher will try to cover up a mistake after it is made, this man will make sure he is right before he goes ahead, even if he spends half his time talking. This man's employer is perhaps just now to be congratulated, because he turns out a good job, and gets good pay for it, but in the end he will have to be consoled for losing his customers, who will go where they can get less talk and more work for their money.

There is still another class of pattern makers, who, like the other good things in this world, are very scarce. These men know exactly what they are going to make before they commence, and just how they are going to make it; therefore when they get at the job, every move they make brings them so much nearer the end, and when they get done they have just what they expected to have—a first class job. These men make no mistakes, or very rarely, and when they do make a mistake they do not try to cover it up with beeswax and black varnish. Let me say, right here, that the man who is not honest about his work, the man who thinks a job is "good enough," and tries to convince himself that it is all right, injures himself most, and this man would not do to make globe valve patterns, at least, he wouldn't suit me.

There cannot be too much care taken in making patterns; but let it be care that is really useful. You don't need to take any extra care to make the job last. To begin with, cut the stuff just as close to the finished sizes as you dare, then don't waste your time in trying to make surfaces to be glued together perfectly smooth; if they are flat that is sufficient, you don't need to touch your bench-planes to them.

Have your glue as hot as you can, and if the room is warm and you put on glue enough to wet both surfaces of the joint, and work spry, you won't have any trouble about getting the glue out of the joint without any rubbing. Now joint your pattern together, put in the dowel pins (metal pins and plates are much better than wooden ones and can be cast very cheaply), and don't waste any time trying to rough out the pattern with a hatchet or draw-knife. If you have followed my instructions in cutting up your stuff, your pattern is already roughed out, and if you haven't, the lathe will help you more than any other tool you have.

The pattern is first to be turned round all over, then let's take a look at Fig. 104. We had best work from the center each way, or perhaps a more general rule in turning is to work from the largest part of the job under consideration. This rule applies equally well to the present case, as the center is the largest part, so we will size up the center and put a fine, sharp line at the center of the globe. Now if your lathe is fitted with a slide rest it will be a great help to you, as by its use you will be enabled to lay off the various points on your pattern, regardless of their diameter, for although you can measure these points accurately upon the surface of the pattern, you must first know the diameters in order to do this successfully; but with the slide rest this becomes unnecessary. Put a square chisel or tool in the tool-post, setting the edge parallel with the center line of lathe. Setting the tool by means of the slide rest at the right distance from the center line, to enable us to turn down to the size of the neck at *a*, and as near as possible to the center of ball, we turn right down to size; we can then carry this size out to each end of the pattern.

The next point will be the shoulder where the flange is set on; and as this is a very essential point we will lay it out with a pair of dividers, from the center of globe, then turn them right down to the finished size, making the first cut directly on the line for the shoulder, and the next at the thickness of the

flange distant, then remove the wood between these two cuts.

Next we come to the prints, and after they are done, take your pattern from the lathe, separate it, and note if the points now finished, viz.: the diameter of globe, the size of necks and prints, and the distance from center and thickness of flanges, are all right. Draw the center line across the drag half of pattern, and with a pair of dividers lay out the outline of ball and fillet where it joins the necks upon the joint of the pattern, and cut away the wood outside the line on one side of the pattern. The right side may be seen by laying the half pattern on the bench *flat side up*, in the position it would occupy in the lathe, that is with the live center to the left, then mark and cut the side towards you.

Saw out the flanges and fasten them on the pattern by a single screw, as shown in Fig. 104, then your pattern may go back to the lathe and be finished as regards turning.

The laying out and cutting to the line and then turning to this line, which, after a little practice, can be done very closely at the first trial by feeling of the surface of pattern while it is running, I consider a better and quicker method than using a template.

Now, having finished the body, let us see about turning up the neck. By referring to Fig. 104 you will see a dotted line drawn from the center of ball *b* to the center of fillet *c*, between ball and yoke flange; this line, where it crosses the outline of pattern, shows the right spot to cut the joint between the body and neck. This joint is shown by a line from the point where the dotted line *b c* crosses the outline of pattern, across the neck to *d*. Having the stuff glued up and ready for the lathe, square up the side next the body, to go on the face-plate. (By the way, a center line is very convenient to have on a face-plate.) Turn the print and groove for the flange, then put on the flange, each part with a single screw, turn up the flange and lay off the distance from face of flange back to joint, and square it down a little way; this will give a line which is square with the print, and will serve to make the joint by; then by laying off the line of joint on the body of pattern parallel with the center line of prints, we shall get the yoke end on square with the body. It is a good plan to leave the neck where it joins on the body a little large, and trim it off after it is glued to the body. This is not to be considered as an acknowledgement of poor workmanship, but rather as a caution, for while it will take but a very few minutes to trim it off, down to the body, and thus preserve the symmetry of the globe, it would make a bad-looking job to be obliged to cut the ball down to the neck.

The body and neck being turned at right angles with each other, it requires some very fine work in centering the two parts of the pattern, and then in turning, especially the ball, to make them match exactly just as they are taken from the lathe. So it is much safer and quicker to leave a little extra stock to trim off than to get the parts to match just as they are taken from the lathe.

One more point: the neck when it comes from the lathe has been cut down, perhaps a quarter of an inch, and is, therefore, square with the center line of neck and print, and also of the correct length to bring the print in the right place. It should not, therefore, have anything more taken off in fitting to the body. To avoid this, I fit the *body* to the *neck*, taking care to make the joint at the correct distance from the center of globe.

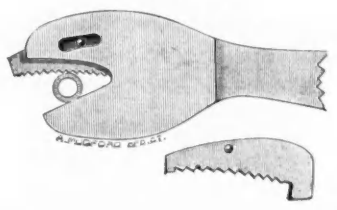
Metal patterns should of course be made hollow, the thickness proportioned to the size of the pattern. For a 6″ valve, say $\frac{5}{16}$″, with extra metal around angles *a a* and dowel pins *b b*, and also where rapping hole *c* are located. (See Fig. 105.)

Make a wood pattern to cast the iron pattern from. As both ends of the valve are alike, we can cast the cope and drag from the same half pattern, which is all we need to finish up. It should be made with the flanges left off of pipe ends, if this pattern is intended to be used on the floor.

If it is to be used on a machine you should still make the wood pattern with flanges left off of pipe ends; then, by putting on either circular or hexagon flanges, we can make castings for iron patterns for either cast-iron or wrought-iron pipe. This applies also to yoke end, if we make more than one style, as is apt to be the case. Thus we get a complete set of one size in all the different styles, from a single half pattern.

This not only saves pattern work, but affords a very cheap and sure method for making all the different styles of one size alike, so that the cores will fit any one of them.

Of course we take it for granted that the moulder will, by using more skill and less muscle give us some castings that don't require much finishing.



Chappell's Improvement in Pipe Wrenches.

The pipe wrench illustrated herewith is the invention of B. F. Chappell, of South Windham, Conn. In general appearance it resembles the so-called "alligator" wrench, but, unlike the alligator, it has a movable jaw, peculiarly shaped and supported, whereby it is claimed certain desirable results are attained. The principle on which this jaw operates is that of a sliding wedge, having its outer edge or face serrated to prevent the slipping or rotation of the pipe. A peculiarity of this movable jaw is the manner in which it is held and backed up by the wrench head. The bottom of the slot in the head that is to receive this movable jaw is curved to exactly fit the inner edge of the jaw, so that a perfect bearing is provided throughout the length of the jaw at all times, thus affording practically as great strength of parts as in a solid wrench of the alligator pattern. The pitch of the curved slot, relative to the fixed jaw, is such that, when a pipe is grasped, the movable jaw immediately slides in its slot and bites the pipe, the grip of the jaws being proportionate to the power applied to the lever handle. A further advantage is seen in the use of a movable jaw, in that it may be readily removed and sharpened, or may be replaced by a new jaw whenever necessary, and at small cost.

The "Buffalo" Glass Oil Cup.

With the increasing use of high-speed machinery, engines and dynamos, the problem of a thoroughly efficient and reliable means of supplying oil to the bearings becomes constantly more important and difficult. At the same time, economy in the use of oil is demanded.

The oil cup shown by the accompanying cut possesses some features of interest in connection with this question. The cut shows the general appearance and construction of the cup. It is of glass, with metallic base and cap. In the base are openings covered by glass lenses, through which the feed can be seen. The feed can be adjusted to suit the requirements, and fastened with a lock nut. It can then be stopped or started instantly, by means of the lever shown in the cut, without interfering in any way with the feed adjustment.

The glass lenses on the sight drop can be easily taken out, cleaned and replaced, or new ones substituted, if broken, by simply unscrewing the bottom of the cup. The lenses being square in shape, can be easily replaced by any one.

The cup can be filled from the top, and has no loose parts to come off and get lost.

The feature by which the feed can be stopped and started at any time without interfering with the adjustment will be appreciated, since, when it is necessary to change the adjustment in order to stop the flow of oil during a temporary stop of the machinery, it is not always easy to readjust the feed to the exact point again, while to let it run is wasteful. These cups are made by Felthousen & Sherwood, Buffalo, N. Y.

Little Forewarnings.

BY T. P. FARMER.

It is the little events, that govern the affairs of life. It is the little things continually turning up here, there and everywhere, that we have to battle with; at first mere specks upon the horizon, like the topsail of some distant ship, they approach, grow and magnify in importance, until they culminate in either pleasure, profit, disappointment or despair. It is the little warnings unheeded that lead to greater things. In the shop, the mill, or the factory, little things mean much. It is "eternal vigilance," or sheer indifference, that soon brings about success or failure. The little jar, the little thump, the little rattle or the little squeak, all foretell something; and *now* is the time to look after them; a few drops of oil or the turn of a wrench may set everything right again; delay until to-morrow or next week, and possibly it will necessitate shutting down for a day or so to make some extensive repairs. A single pane of glass in a certain window of a large factory led to the discovery of a chain of events, each small in itself, but as a whole resulting in a loss of several hundred dollars' worth of goods. On a certain day, the inspector employed at the factory rejected a particular line of goods as imperfect; on that same day a single window-pane began to rattle; explanations regarding the imperfect goods were at once demanded, and resulted in placing the blame upon the operatives, and the discharge of a good foreman of that department; the next day the mischief continued, and the blame was shifted to the machines; but why a dozen or more machines of the same kind had all kicked up at once, was a conundrum.

After much deliberation, it was finally decided the trouble was caused by vibration, although not the slightest motion was perceptible, and the only thing in the whole building apparently affected, or to arouse suspicion, was the trembling of that single pane of glass that had worked loose in the putty, and which at first was attributed wholly to the unison of sound with some other sonorous body. It being in the early spring, the foundations of the factory were first examined, and in so doing it was discovered that a part of the masonry in the wheel pit (power being a large breast wheel) had settled. In digging down it was found that some of the small stones had worked out, leaving a large one in such a position that, when the wheel was in motion—it having been thrown out of plumb—caused this stone to tilt, and one of its corners to hit against the end of an old piece of joist, that for some unaccountable reason had been buried there, the other end of which butted against the foundation wall of the building, and on the same side having the window with the loose glass—though a hundred and forty feet away. One blow with a sledge, and the joist was knocked aside; from that moment the pane of glass ceased to rattle, and there were no more imperfect goods. It was clearly demonstrated that these delicate machines were rendered useless by a vibration so slight as to be imperceptible to the senses, and it might have necessitated the loss of much time and money to discover the true cause of the defective goods, but for that little pane of glass.

As the object of all study and the end of all wisdom is practical utility, so the regard for little things is the foundation of the greater and final result. If the so-called "trifling affairs" in the shop are carefully looked after, never fear but what the large ones will receive proper attention. The lack of a little foresight in our make-up is a deficiency we all sadly regret; we readily see our mistakes when it is too late, and blame ourselves for our thoughtlessness. We deliberate as to whether we shall use screws or rivets to join those parts together; the decision is finally made, and when we are pulling off our boots at night, and thinking over the events of the day, we wonder why it did not occur to us to use bolts instead of either; they would have been so much better in the case of repairs.

If we had but thought to see if that drill was ground true, this hole would have been all right; if we had thought to look at the number, or tried our gauge or scale on that tap, the hole would have had the right thread. In other words, if our foresight was only equal to our *hindsight*, we should avoid many an oversight. It is the single clogged tooth in the file that will cause it to slip, and the slip of a file that will mar the work. It is the thousandth part of an inch that prevents a fit, and the same miscalculation that will nearly send a good workman into one. It is the angry word that will cause ill feelings and poor work, and the little pat on the back that gives encouragement and good work. It is the pinch of grit that spoils the bearing, the slight play of the wrench that defaces the nut, and the single squirt of tobacco juice that will rust a half peck measure of finished screws—all little things, and when once experienced should be stored away in some corner of the brain, as little warnings for future use.

Little things should be respected. I was once acquainted with a man who boasted that he would not be governed by little things, or bothered by what he called "petty annoyances"; that he would not stoop in the street to pick up anything so small as a ten-cent piece; he would not gratify the little temptation; and still, a few years later, that same man begged of me, with tears in his eyes, to give him a dime to buy a glass of whiskey. He was not only governed by little things, but he had been beaten by them; and then, in his miserable condition, a ten-cent piece seemed almost the connecting link between life and death; for all his bravado, his disregard of little forewarnings brought him to a sad ending. Something equivalent to the turn of a wrench in his early days might have saved him.

Yes, it is the little things in this world that teach and direct us; life is made up of them; we are but little things ourselves. It is when from some mountain top we view the broad expanse, or, sailing across the mighty ocean, that we appreciate that sense of smallness, and compare ourselves to the grain of sand upon the shore. We come, we tarry a little, then pass away like the flower that blooms at dawn, only to wither at the close of day. T. P. FARMER.

W. A. Walden has been appointed master mechanic of the Atlanta & Charlotte division of the Richmond and Danville Railroad, with headquarters at Atlanta. S. J. Neisler takes Mr. Walden's place as foreman at the Charlotte shops.

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The Local Steam Engine Trade.

When the automatic cut-off steam engine came into anything like common use in this country, the tendency was directly towards concentrating the business of steam engine building. The patents were for some years in the hands of a few individuals, and in contracting for a first-class steam engine there was choice of only a few places in the country. The builder of the common type of engine—the slide valve engine—had, like the proverbial shoemaker, to "stick to his last," letting the trade for better engines go elsewhere, congratulating himself meanwhile that the cheaper engine was good enough for the majority of users in his vicinity.

But as water finds its level, so this is being changed, or has been changed, until a large percentage of those who build steam engines make, in addition to their "plain" engines, engines of the automatic type. This is generally the first move made; the second is to confine themselves entirely to the better class of engines.

Years ago, there was a good deal of local pride in the steam engine trade. The local builder expected to supply the engines required in his vicinity, and he considered it in some sense a reflection on his ability to do good work at a fair price, if he did not get all the local orders. And there was a sort of neighborhood pride in buying of the local builder, that is lacking to-day. Instead of selling his engines almost exclusively within a few miles of his shop, the builder now expects to sell all over the country, and he expects that a good many of his neighbors will use engines he did not build.

The advent of the automatic engine has, so to speak, done away, in most parts of the country, with what may be termed the local trade of the builders of steam engines. As soon as the engine builder—driven to such a course perhaps because he sees his home trade leaving him—brings out an automatic engine, he looks after a wider reputation. He thinks, or he ought to think, that his engine has peculiar merits of its own, and territorial limits disappear.

Undoubtedly, many times the builder of plain steam engines adds an automatic to his list in hopes merely to hold the trade in his locality—trade he previously held. But he is not likely to stick to that idea very long. He finds that business methods have changed in that respect, and that it is necessary to reach out for trade. Builders from a distance are taking some of his local trade, and he will look after some of theirs. Even a prophet, we are told, has more honor abroad than at home, and it is no discredit to a builder of steam engines that his engine sells better in some other locality than in his own. In his efforts to make something to suit his own local trade, he may have made something that will suit the trade elsewhere better.

Scattering the products of steam engine builders—forcing them to seek outlets for their engines in sections of the country wide apart—is excellent as an educational feature. Not only users of steam engines, but builders as well, learn something from the various kinds of engines they are brought in contact with.

Instead of the general use of the better types of engines gradually driving men out of the business of building steam engines, it appears rather to have stimulated invention, causing effort to keep up with the times, and widening the field in which they work. No steam engine builder to-day is satisfied with a trade that is purely local, and cheap freights and improved shipping facilities give him outlets that were lacking only a few years ago.

Honest vs. Dishonest Speculation.

It is evident from the discussions going on in the press and elsewhere regarding speculators and speculative operations, that many of the persons discussing the subject fail to recognize the fact that there is, or can be, such a thing as legitimate and honest speculation. In these days it is true that a person may easily be pardoned for such a failure, for the speculations which are neither legitimate nor honest seem to predominate so largely as to make the other kind almost unnoticed. Nevertheless, there is always a great deal of speculation going on which is not only legitimate, but positively beneficial to general commercial and manufacturing interests, performing for them an office similar to that performed by the fly-wheel of an engine.

Sudden and violent fluctuations in the prices of raw materials are by no means to be desired by the manufacturer, for they often seriously interfere with manufacturing operations and make the outcome of contracts entered into, doubly uncertain. A manufacturer who makes a proposal to furnish certain articles at a certain price must be reasonably certain that the materials of which those articles are made will not double their price before the contract can be filled; and it is just such sudden, violent and disastrous fluctuation, which legitimate speculation tends to prevent.

If, by reason of an unusually heavy production of any certain crop, or commodity, or by a great falling off in consumptive demand, the price of that commodity begins to fall, it may soon reach a point at which any person thoroughly familiar with the world's average production and consumption of that article, and sagacious enough to estimate at their true value the temporary causes tending to lower prices, can perceive that there will be a probability of profit by purchasing, to be again sold when prices shall be restored to or above their normal figures. The legitimate speculator having the capital necessary for such operation, buys when this point is reached, and his purchases have a direct tendency to prevent prices going as low as they otherwise would; and if there are enough others like him, their combined purchases may constitute a demand sufficient to arrest the downward tendency, though this will of course be a speculative, instead of a consumptive demand.

Now if, by reason of a falling off in production, or a large increase in the demand for immediate consumption, prices show a tendency to rise to an unnaturally high figure, they soon reach a point at which there is a profit to the speculator in selling his accumulated stock, and his selling has a direct tendency to check the rise in prices.

The effect upon business of this sort of speculation is exactly like that of a fly-wheel upon an engine crank-shaft; which, when there is a surplus of energy over and above what may be needed, takes it up; and, when a sudden demand is made for more power, gives it out again; thus keeping the fluctuation of speed within certain narrow limits. But some power goes into a fly-wheel which is not again given out in useful work, but is expended in fanning the air, and in friction caused by the additional weight; yet this loss of power is borne, in consideration of the benefits secured. So it is with the legitimate speculator; he may make some money, but the amount will be very small compared with the volume of business affected by his operations, and can well be afforded by the producing, manufacturing and business interests.

It is only the speculators who are in reality gamblers, and who resort to gamblers' methods, that work injury to manufacturing and commerce.

When a speculator so operates as to produce artificial conditions of scarcity or plentifulness of the things in which he operates, and attempts to affect prices in his favor by such means and by the deceit and misrepresentations which necessarily accompany them, and when, instead of actually buying the things dealt in, he deals in margins, options, etc., he becomes a gambler, whose operations, instead of tending to prevent sudden and violent fluctuations, usually have a direct tendency to produce them; to unsettle business, and add uncertainty to manufacturing and commercial operations. It is this sort of speculator whom the people should take measures to protect themselves from; but in doing so the difference between speculation which is robbery and plunder, and that which is harmless, or even beneficial, should be distinctly borne in mind. We frequently hear it declared that "speculation in the necessaries of life is robbery, and must be suppressed." It depends upon the character of the speculation. A man who honestly thinks that natural causes will bring about a rise in price of any commodity, and has the capital to invest in that commodity in anticipation of that rise, has an undoubted right to do so, so long as he refrains from employing the methods of the gambler, and from bringing unnatural influences to bear for the purpose of affecting prices.

The reform of any great wrong is always retarded, if not entirely thwarted, by a failure to make a clear distinction between that which needs reforming and that which does not need it.

Imported Clocks.

There are a good many imported clocks in this country; those imported in late years are here for no other reason in the world than because it is the fashion to buy things made abroad. The imported clock is not as good a timekeeper as the American clock. On the contrary, it is well known that the foreign-made clock will not compare with the American clock so far as telling the hour of the day is concerned. But there are a good many people in this world who do not buy clocks to keep time. It is, in a very cheap way, fashionable to possess a French or a German clock, and that is all there is of it. Fashion covers a multitude of deficiencies. These imported clocks are mounted in fancy cases, and there is quite a large class of Americans to whom the name of Paris or Berlin has a sort of undefined fascination.

It is safe to say that the American who buys an imported clock does it from some other motive than an utilitarian one.

The fancy cases in which French and German clocks have been enveloped has undoubtedly had something to do, in the past, with their importation. But to-day American clocks, put up in cases *bizarre* enough to suit the taste of the most fastidious, can be found. The style of the case or the quality of the works does not cover the reason why foreign-made clocks are bought in this country. And as to cost, the American clock is much the cheaper. The simple reason, to-day, why French clocks are popular is because they are French.

American clocks are exported in large quantities, and sold just where French and German clocks are made. The exported clocks are sold because they keep time, and are cheap as to cost.

A great many things of foreign make are used in this country for the same reason that French and German clocks are used. "It is English, you know," or "It is French, or German, don't you see?" has a good deal to do with it.

Rewards for Meritorious Discoveries and Inventions.

[We have received the following, which we publish because it gives information not generally known.]

The Committee on Science and the Arts of the Franklin Institute, of the State of Pennsylvania, respectfully requests that you will cause to be made known to the readers of your influential journal, the fact that the committee is empowered to award, or to recommend the award of, certain medals for meritorious discoveries and inventions, which tend to the progress of the arts and manufactures.

These medals are:

I. The Elliott Cresson Medal (Gold). This medal was founded by the legacy of Elliott Cresson, of Philadelphia, and conveyed to Trustees of the Franklin Institute. By the Act of the Institution, May 17th, 1849, the Committee on Science and the Arts was designated and empowered to award this medal, and the committee decided to grant it, after proper investigation and report by sub-committee, either for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process or combination of materials in manufactures, or for ingenuity, skill, or perfection in workmanship.

II. The John Scott Legacy Premium and Medal (Twenty Dollars and a Medal of Cop-

per). The John Scott legacy premium and medal was founded in 1816, by John Scott, a merchant of Edinburgh, Scotland, who bequeathed to the City of Philadelphia a considerable sum of money, the interest of which should be devoted to rewarding ingenious men and women who make useful inventions. The premium is not to exceed twenty dollars, and the medal is to be of copper, and inscribed "To the most deserving."

The control of the Scott Legacy Premium and Medal (by act of 1869) was transferred to the Board of Directors of City Trusts, and referred by the Board to its Committee on Minor Trusts, and that committee resolved that it would receive favorably the name of any person whom the Franklin Institute may from time to time report to the Committee on Minor Trusts, as worthy to receive the Scott Legacy Premium and Medal.

The Franklin Institute, by resolution in 1882, accepted the above-named action of the Committee on Minor Trusts, and referred the duty of making such recommendations to the Committee on Science and the Arts. The committee determined that the recommendation for such reward shall be made on the favorable report of a sub-committee which shall be appointed to examine the invention or discovery.

The committee requests your co-operation in facilitating the making of the aforesaid awards for meritorious discoveries and inventions, by bringing the facts herein set forth, to the knowledge of your readers.

Upon request therefor, from interested parties, made to the Secretary of the Franklin Institute, full information will be sent respecting the manner of making application for the investigation of inventions and discoveries; furthermore, the Committee on Science and the Arts will receive and give respectful consideration to reports upon discoveries and inventions, which may be sent to it with the view of receiving one or the other of the awards herein named, and full directions as to the manner and form in which such communications should properly be made will be sent on application.

By the Committee's order,

WM. H. WAHL, *Secretary.*

The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts. Philadelphia, October 1st, 1888.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(495) G. F., Philadelphia, Pa., asks: How shall I proceed to learn the profession of a mechanical engineer? Can you recommend me to a good school? I am 30 years of age. *A.*—The best way will be to join a technical school in which mechanical engineering is taught. There are a number of these schools, all of them good; send to these for catalogues and make your own selection. 2. Are the articles on Practical Drawing still running in the AMERICAN MACHINIST? *A.*—Yes.

(496) Stack, Newark, N. J., writes: I have a horizontal return tubular boiler, 17 feet long 6 feet diameter, with 136 3-inch tubes. The grate is 6 feet x 6 feet 6 inches; the stack is 60 feet high, with circular flue 26 inches in diameter. I am burning about 3,300 pounds of Lehigh pea coal for ten hours, to get about 100 horse-power of work, and this is about all that I can get out of it. Now I would like to know if either one or both of the following methods will do me any good? First, by increasing my grate surface to 7 feet x 6 feet 6 inches, Second, by taking out the inside of my stack and increasing the circular flue to 34 inches diameter. *A.*—We believe that you will obtain better results by increasing the grate area to 7 feet x 6 feet 6 inches, as you propose. The inside diameter of the stack we should increase to 32 inches, instead of 34 inches.

(497) A. D. H., Atlanta, Ga., writes: I had a dispute with two of my fellow machinists. We were engaged in putting machinery into a large oil mill near the city. When we came to the boilers there we hitched. There were five boilers fed by a two-inch pipe from a force pump. In addition to this pump, an injector had also to be attached; its feed pipe was 1¼ inch diameter. Now, they wanted to couple the injector feed-pipe to the 2-inch pipe. This latter pipe was 50 feet long, it had 5 checks, 5 globe valves, and seven elbows, all 2 inches. I claim that it would not be giving the injector fair play to feed through so large (2-inch) a pipe. I claim that under these conditions the injector will not work satisfactorily. Who is right? *A.*—We believe that, on account of the length of pipe and the number of elbows, the injector will work better with the 2-inch feed-pipe than with the 1¼-inch pipe, but at the same time do not advocate the practice of using the same feed-pipe for the injector and pump; each should have a separate feed pipe.

(498) B. C., Portsmouth, Va., asks: Please give me the method for galvanizing wrought-iron. *A.*—The wrought-iron is first immersed in a cleansing bath of equal parts of sulphuric or muriatic acid and water, used warm. It is then scrubbed with emery or sand, to clean it thoroughly and detach all scales, if any are left; after which it is immersed in a preparing bath of equal parts of saturated solutions of chloride of zinc and chloride of ammonium, from which bath it is directly transferred to the fluid metallic bath, consisting of 20 chemical equivalents of zinc to 1 of mercury; or, by weight, 640 pounds of zinc to 106 of mercury, to which are added from 5 to 6 ounces of sodium. As soon as the iron has attained the temperature of this hot fluid bath, which is only 680 degrees Fahrenheit, it may be removed, and will then be found thoroughly coated with zinc. Care must be taken not to leave the iron too long immersed in this bath, as its affinity for iron is such that it may become dissolved. This is the case with thin plates of wrought-iron; even when ⅛ inch thick they may be dissolved in a few seconds. It is safe, therefore, to let the bath previously act on some wrought-iron, so that it dissolves a portion of it, in order to satisfy its inconveniently great affinity for this metal.

(499) W. H. S., Norwich, Conn., writes: 1. I buy iron or steel, weigh it carefully, take it to a blacksmith, have it cut up and forged to shape, without apparent waste; weigh the forgings carefully when done, and always find they fall considerably short of the first weight of the metal. Please explain how this occurs, and, if possible, give the percentage of loss in forging iron and steel. 2. Does a piece of iron or steel brought to a red heat and allowed to cool, without hammering, lose a certain part of its weight? If so, what per cent.? 3. Will a milling cutter or other similar article change its weight in hardening? If so, to what extent? *A.*—We have referred these questions to our contributor, B. F. Spalding, who answers as follows: If there is no waste in scrap there is no reason for any diminution in weight, except through oxidation. The loss from this source may be determined by the amount of scale produced. The scale, scrap and finished product collected should weigh as much more than the original metal as the weight of the oxygen which has entered into combination with it. This amount will vary in proportion to the amount of exposure it has to the action of the air while rendered susceptible to its effects by heat. The loss of metal by scaling is greater on small than large work, more on squares and flats than on rounds and octagons. It should not exceed two per cent. per heat on one inch square steel, or fifteen per cent. on half-inch round iron. The specific gravity of steel diminishes by hardening in proportion as the metal increases in volume. This amount is governed by the conditions to which it is subjected, and no rule of percentage is of universal application. The absolute weight of the whole piece may or may not change, as it is subject to these conditions. Practically, the difference in weight would not be observed.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p 16.

Link-Belting.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Fuel oil burners. A. E. Jenkins, Scranton, Pa.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Lamb-Knitting Machine Co., Chicopee Falls, Mass.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"Swift" Sight Feed Lubricator; no glass tubes; simple, reliable. Swift Lub'r Co., Elmira, N. Y.

Castings for small and medium sized vertical engines. Humphrey's Foundry, Bellefontaine, O.

Working drawings furnished by A. L. Stevens, mech. engineer, 11 S. Ninth st. Philadelphia, Pa.

Davis Key-Seating Machines, kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Brown & Sharpe Mfg. Co. have a line of machinery with S. A. Smith, 23 S. Canal st., Chicago, Ill.

Patents—Whittlesey & Wright, 705 8th st., N. W. Washington, D. C. Send for pamphlet and references

Ice and Refrigerating Machines; 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

For the latest improved Diamond Pospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Upright drills, improved, sizes 21", 23", 25", 28", 32", 36" swing; finely made and great capacity. Currier & Snyder, Worcester, Mass.

Engine lathes, hand lathes, fine tools, files and supplies for machinists and other metal workers. Frasse & Co., 92 Park Row, N. Y.

Machinists' supplies, brass goods, m'f'rs supplies, polishing materials, all kinds wire, metals, etc., in any quantity. Jordan & Gottfried, 208 Canal st., N. Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.

Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N. Y. City.

A gold medal and two silver medals were awarded The Waterhouse arc system at the Centennial Exposition, Cincinnati. Address The Waterhouse Electric and Mfg. Co., Hartford, Ct.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing gray iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.

A system of easy lettering by J. H. Cromwell, giving 26 forms of alphabets. The space to be lettered being divided into squares; simple and effective. Price 50 cents. Catalogue of books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st, New York.

"Practical Drawing," by J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including Nov. 3, 1888 issue, 62 articles have been so far published. Copies containing these articles, sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction," by J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 76 articles have thus far appeared up to and including the Oct. 27, 1888 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

Ellis & Frederick will build a saw mill at Bear Creek, Ala.

The Athens (Ga.) Gas Light Company will put in an electric light plant.

J. P. Stegall is interested in building malleable iron works at Emerson, Ga.

Henderson & Brothers will erect a carriage factory, 150 x 75 feet, at North Cambridge, Mass.

Work is to be begun at once on the extension of the boiler shop of the Portsmouth navy yard.

The Sherman Iron and Machine Works, Sherman, Tex., recently burned, will be rebuilt at once.

The Rowan Knitting Company has been organized, to build a knitting factory at Salisbury, N. C.

The Gaffney City (S. C.) Manufacturing Company has been chartered to build a $200,000 cotton mill.

The Ohio River Railroad Company contemplate building new machine shops at Parkersburg, W. Va.

The Kimble Steam Engine Company has been organized at Kalamazoo, Mich. Capital stock, $100,000.

The Alabama & Great Southern Railroad Company will build additional works at Birmingham, Ala.

The Louisville Southern Railroad Company will move their machine shops from Louisville to Harrodsburg, Ky.

A company with a capital of $50,000 has been organized at Atlanta, Ga., to build and operate stove works.

The Adams & Price Locomotive and Machine Works, Nashville, Tenn., are increasing facilities for manufacturing.

The Gilsum Manufacturing Company, Gilsum, N. H., manufacturers of woolen goods, will double the capacity of the works.

There is water-works agitation at Johnston City, Tenn.; Hancock, N. Y.; Smith Center, Kan.; Portsmouth, Va.; Marietta, Ga.

R. A. Hooton & Co., of Danville, Ill., will erect a planing mill and sash, door and blind factory, to cost $10,000, at Pineville, Ky.

The Stearns Manufacturing Company, Erie, Pa. are finding it necessary to add to their shop facilities. They employ 450 hands.

The Planters' Oil and Mfg. Co., West Point, Ga. has been chartered with a capital stock of $200,000, and among other things will operate a cotton and woolen mill.

The Hersey Leather Company has been incorporated, to operate at Fon du Lac, Wis. The company propose to manufacture leather by some new process that will materially shorten the time.

John Wiley & Sons, 15 Astor Place, New York, have issued a sheet descriptive of books just out, also of books in preparation. They have recently added several important works to those previously published.

The Wardwell Needle Company, of Lake Village, N. H., are building a new factory near their present location and expect to have it completed before the first of January next. They will occupy their present shop until the new factory is ready.

The Evansville (Ind.) Lead and Spar Mining Company has sold its mining property to the Mullins Silicated Iron and Steel Company, St. Louis, Mo. This last named company will work the mines on a large scale, which is expected to greatly reduce the cost to consumers.

The George E. Bennie Mfg. Co. will erect a factory for manufacturing well buckets, pails, churns, etc., at Florence, Ala. The buildings will consist of a structure 50 x 40, dry house, 40 x 40 feet, and an engine house. The company have a capital stock of $25,000 and remove from Tennessee.

The Hammer & Forbes Company, Burnside, Ct., is building an addition 50 x 62 feet, to its mill. New rotary boilers will be set up in this building and new dusters and other improvements added. A tower 52 feet high adorns the front of the building, on which will be placed a large water tank to be used in case of fire.

The pulp manufacture is apparently becoming one of the foremost industries in the western part of Massachusetts, and the mills have been unable to keep up with their orders during the present autumn. A raft of 300,000 feet of spruce logs was started from Brandon last week down the Otter creek to the mills of the Green Mountain Pulp Company of Middlebury, which makes 50 tons of pulp a day.

The Angelica (N. Y.) Foundry and Machine Co's shops, leased some five years ago by the L. & P. R R., have come back into the hands of the original owners, of whom J. T. Brown is president. The shops are well equipped with machine tools, and foundry has a 40" cupola. It was the original intention of the company to make car wheels, etc., but now a general machine and repair business will be done.

Frank V. Strickland, of Bangor, has purchased the foundry in Foxcroft, Maine, operated for some time past by the Foxcroft Foundry and Machine Company, and it will be run henceforth by him in partnership with A. B. Smith, who was a member of the old company. Mr. Strickland has been connected with both the Bangor Foundry and Machine Works and the Hinckley & Egery Iron Works, but of late has been located at Woodstock, N. B.—*Industrial Record.*

The Phosphor-Bronze Smelting Company, Philadelphia, Pa., have issued a very convenient circular and complete price list of phosphor-bronze material. They manufacture phosphor-bronze, sheet and rolls, wire and rods, ropes for all purposes, wire cloth, rods, chains, bolts, washers, wood screws in fact they manufacture phosphor-bronze for almost every conceivable purpose. This company is the original manufacturer of phosphor-bronze in the United States, and owner of the United States patents.

The Springfield (Mass.) Glue & E. Wheel Company have just received 40 tons of garnet, and have 50 tons more on the road. This substance is brought from a mine that the company recently bought at Minerva, N. Y., about eight miles from the Adirondack Railroad. The purchase covers 32 acres, and as the strip is bounded on one side by the public highway it is easily accessible. The rock is very hard, and when crushed each particle has very sharp edges, so that for cutting it is said to be superior to ordinary sand paper. The mine is large and will last for years, so that it is an especially important "find" for the company.

The Hoppes Manufacturing Co., of Springfield, Ohio, have issued a new catalogue, illustrating and describing their live steam feed water purifier and exhaust heater. It is neatly printed and well illustrated, full directions being given for setting up and managing their productions. A feature is the reproduction by photographic process of a number of letters from steam plant owners and manufacturers using their purifiers and heaters. With the catalogue there is a blank form, to be filled out by persons wishing to obtain prices. This blank, when filled out properly, answers all the questions needed to know what is required for the given conditions, and we should think is well calculated to prevent misunderstanding and unnecessary letter writing.

The Anniston, Ala., *Daily Hot Blast* says: The United States Rolling Stock Company, of this city, have decided to build two large saw mills, one in this State and one in Mississippi, to cut timber from their own land for use in their car works. This will give them an abundant supply of the finest lumber, cut exactly to suit their requirements, and will obviate any possible difficulty in securing suitable lumber in the open market. Cutting their own lumber, both oak and pine; making their own wheels, axles, bolts and forgings, these Anniston car works will have advantages for building cars not equaled by any other car works in the United States. The foundation of their new foundry, 200 x 125 feet, has been laid. This will be followed by the rolling mill, the big car shop, which is to be nearly 1,000 feet long, and the other new buildings, for which the ground is being cleared. By early spring, new buildings will, it is expected, be all finished, and then Anniston will have one of the greatest car works in the world.

Machinists' Supplies and Iron.

NEW YORK, Nov. 3, 1888.

Iron—American Pig—The market rules quiet, no change of importance having taken place. There is no large stock in the hands of furnacemen, and prices therefore rule steady. We quote Standard Lehigh and North River brands, No. 1 X Foundry, $18.00 to $19; No. 2 Foundry, $17 to $17.50, and Grey Forge, $15.50 to $16.25.

Scotch Pig.—We quote Coltness, $21.50 to $21.75; Gartsherrie, $21 to $21.50; Summerlee, $21.75 to $22; Eglinton, $19.25 to $19.50; Dalmellington, $20.25 to $20.50; Clyde, $20.50; Langloan, $20.56.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—See bottom of third column, page 11.

Draftsman—A competent man wants situation as assistant draftsman. Age, 30. Box 37, AM. MACH.

A first-class pattern maker, English, wants a position as foreman; good draftsman; age 33. Box 35, AMERICAN MACHINIST.

Wanted—Two first-class vise hands, accustomed to engine work. Davenport Foundry & Machine Co., Davenport, Iowa.

Wanted—Travelers for New England and Middle States, to handle mechanical goods; liberal commission. Box 17, AMERICAN MACHINIST.

Wanted.—A working foreman for machine shop, one who can handle men and do work in modern style. Country, AMERICAN MACHINIST.

Wanted—Situation as drummer by man thoroughly acquainted with Eng., Ger., and all kinds of steam eng. Address C. G. S., care AM. MACHINIST.

Wanted—A young man in drawing office, with fair knowledge of drafting and some experience. The D. A. Tompkins Co., Charlotte, N. C.

Wanted—Traveling salesman to sell injectors and other engineering specialties. Felthousen & Sherwood. 118 Church st., Buffalo, N. Y.

Situation wanted by a mech. and civil engineer, and draftsman; graduate of technical high school, with several years' shop prac. M. M., AM. MACHINIST.

Wanted—By practical patternmaker and draftsman, position as foreman pattern maker. S. K. AMERICAN MACHINIST.

A young man, theoretical education, with 2 yrs. in mach. shop, desires position in a good m't'g concern; understands drafting. Box 39, AM. MACHINIST.

Foreman Wanted—One competent to take charge of a machinery pattern shop. Address, with record of experience and reference, Box 93, Albany, N. Y.

Foundry foreman of 20 years' experience desires to enter into a contract with a responsible firm to make their work by the ton or take charge. Address Box 36, AMERICAN MACHINIST.

Draftsman—A practical man with technical education, and some good experience, wants a situation. Dies and special machinery preferred. Good references. Address J. R., AMERICAN MACHINIST.

A practical mechanic, thoroughly understanding soap manufacture and machinery used therein, can get track of a position by addressing, with refs. The Seeger & Guernsey Co., 7 Bowling Green, N. Y.

Mechanical draftsman, competent designer, able to estimate work and handle men, is open for engagement; first-class references given. Address Draftsman, AMERICAN MACHINIST.

Wanted—A young man, neat at making tracings and figures, who has had some experience in mechanical drafting, and desires to improve. Address Box 38, AMERICAN MACHINIST, giving experience, and salary expected.

Wanted—English fitters or turners returning home, who have worked in first-class shops in New England, manufacturing highly finished work, to please apply, either by letter or personally, to George Richards & Co., Limited, Broadheath, near Manchester, England.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent Boiler Tube Expander; second to none; price in reach of all. Crescent Mfg. Co., Cleveland, O.

The Crescent Link Belt Coupling; something new; sample free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., consulting engineer for hydr. and pumping machinery, etc.

Correspondence solicited with parties having machine or foundry specialties to build. Honesdale Iron Works, Honesdale, Pa.

For Sale.—Patent of my new Pipe Wrench, illustrated in AMERICAN MACHINIST of this issue. B. F. Chappell, So. Windham, Ct.

Wanted—Partner to take interest in a machine shop in the West, with good paying buiness; a man wanted who can invest $4,000 or $5,000 cash. K. K., care AMERICAN MACHINIST.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted—Inventors to know that business placed in my hands receives my personal attention from beginning to end. R. G. DuBois, Patent Attorney, Washington, D. C.

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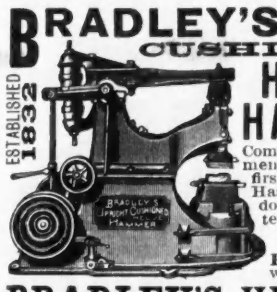

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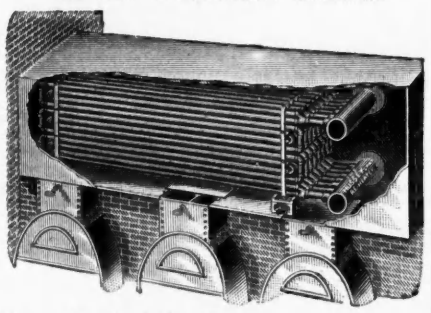

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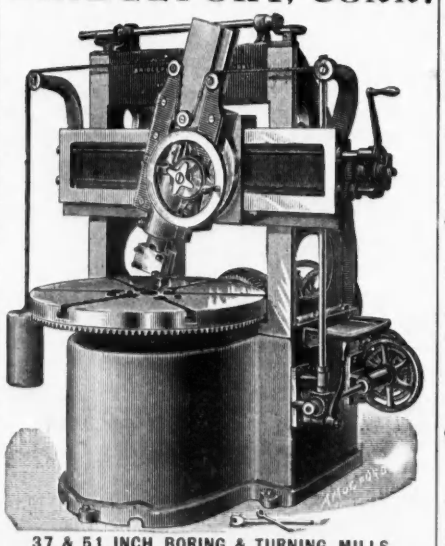

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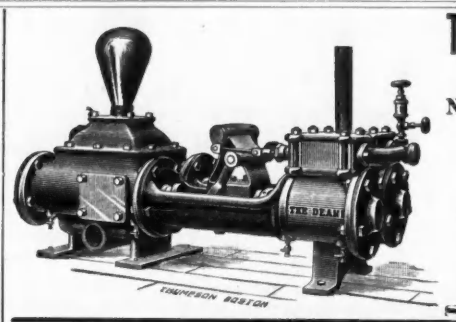

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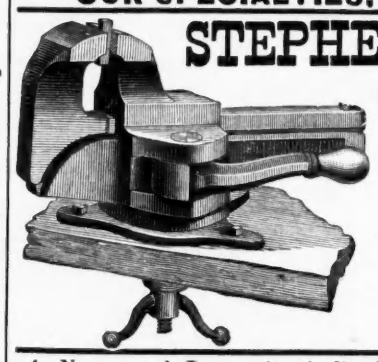

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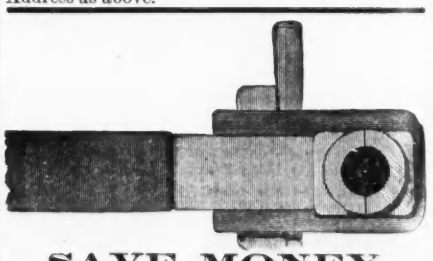

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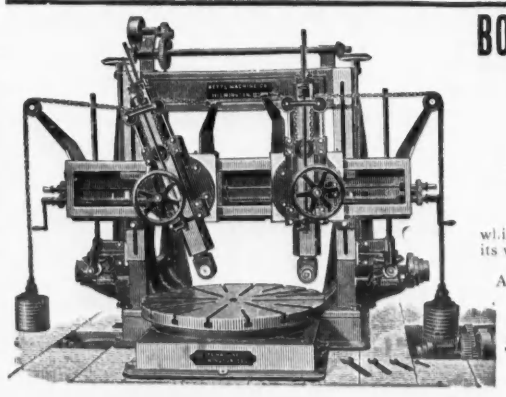

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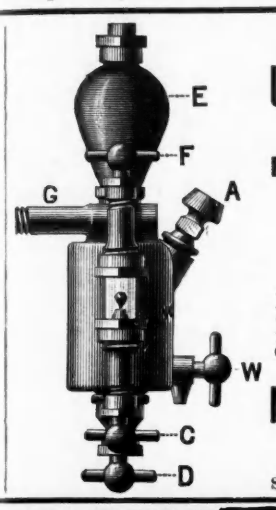

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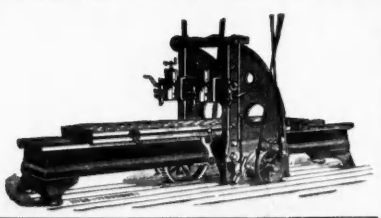

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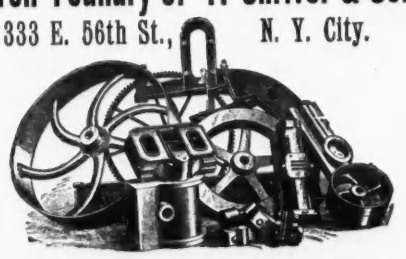

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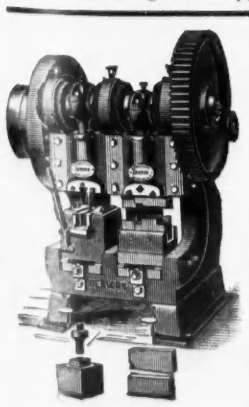

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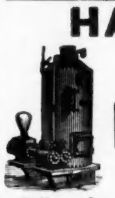

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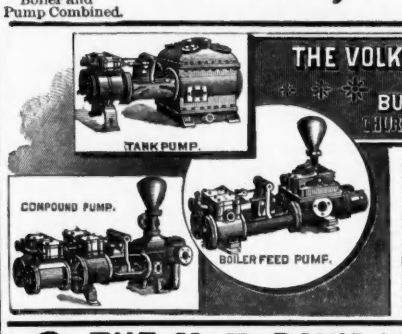

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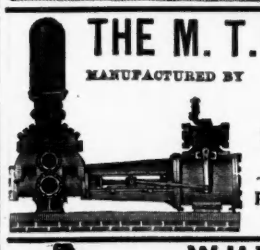

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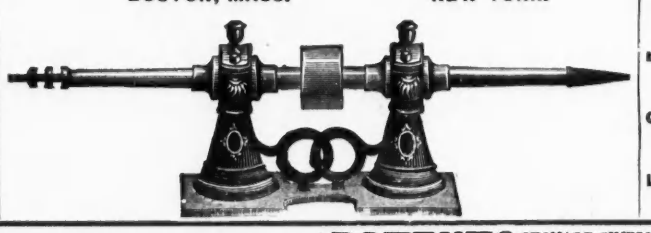

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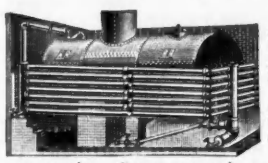

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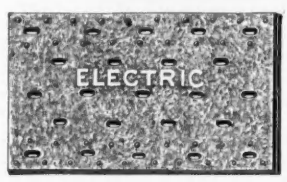

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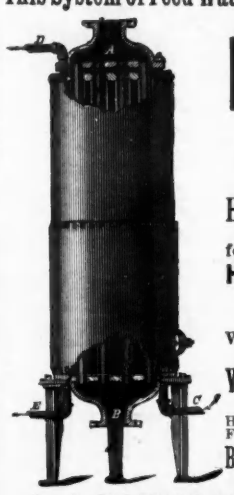

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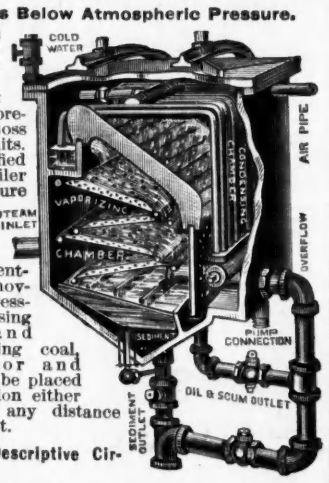

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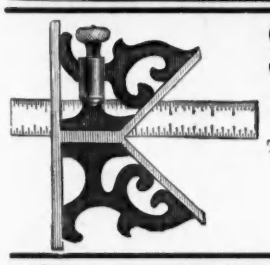

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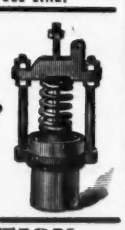

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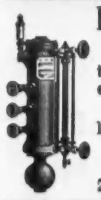

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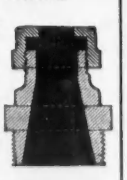

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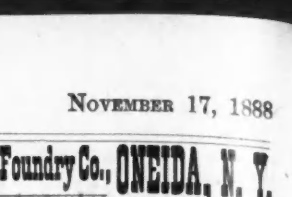
21 1-4 in.	26 in.
24 in.	30 in.
30 in.	36 in.
36 in.	43 in.



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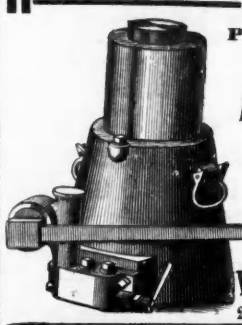

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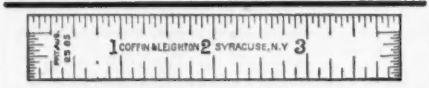

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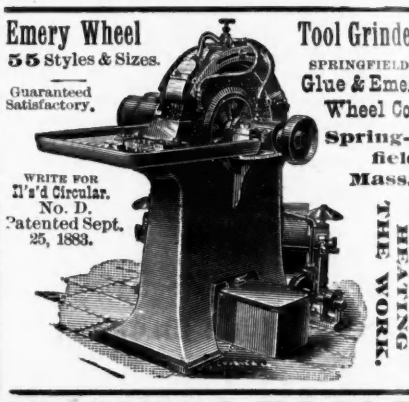

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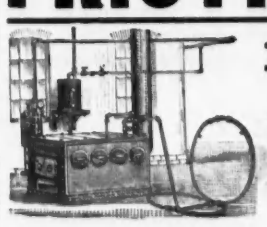

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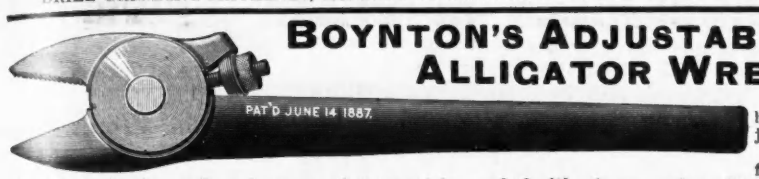

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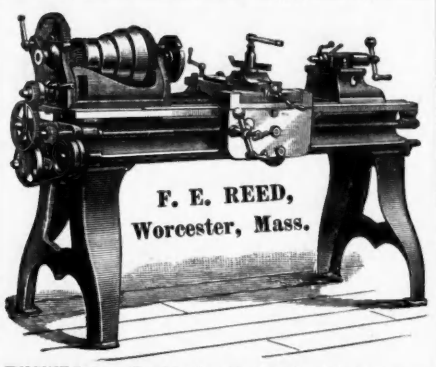

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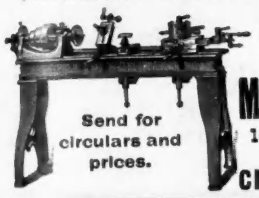

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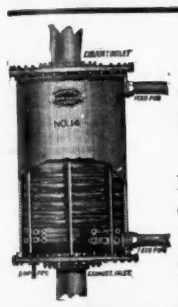

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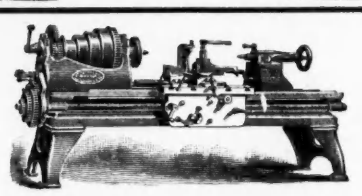

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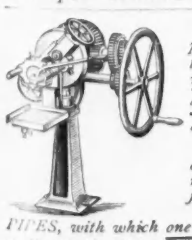

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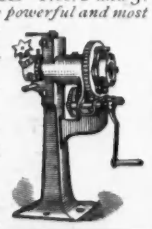

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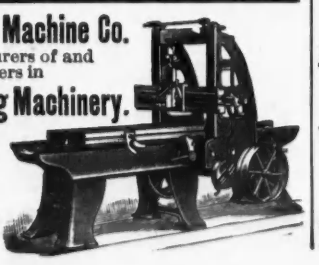

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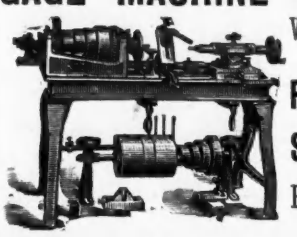

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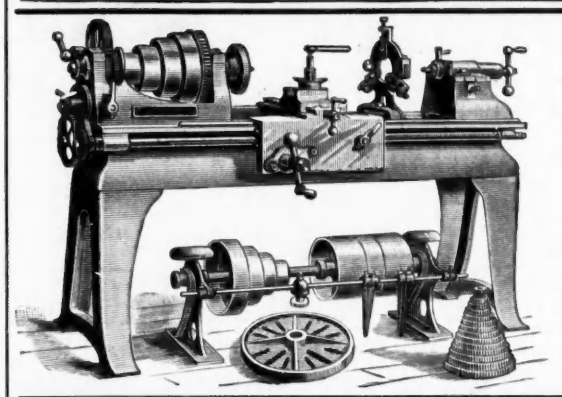

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To the Committee on Rules, Jurors and Awards.

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We, your committee appointed to make examination of Class 6, Group 41, have performed that duty, and find as follows:

Engine Lathe; The G. A. Gray Co., Cincinnati, O. The points of excellence of this lathe over others exhibited are:

1st. Design and Proportions.
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This lathe having shown in a number of different measurements, not only a superiority over all others examined, but a perfection seldom attained in machines of this class,

We award a Gold Medal.

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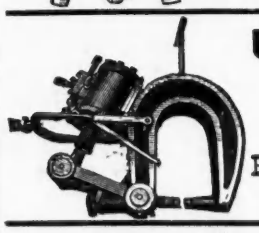

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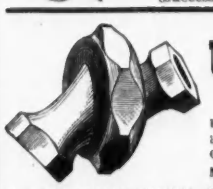

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Combining an elbow and union, and can be set at any angle at which it is desired to run the pipe.
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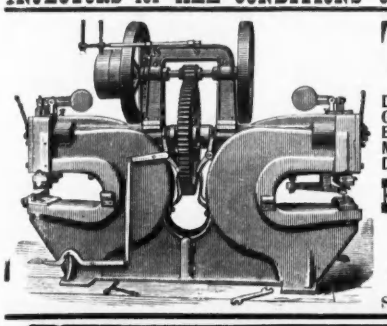

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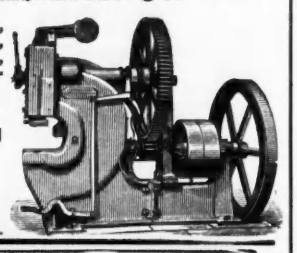

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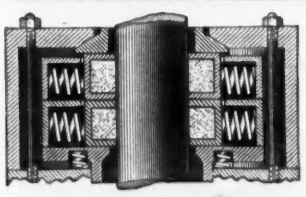

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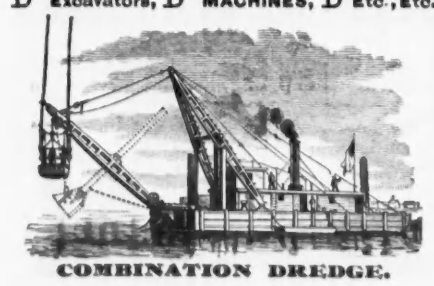

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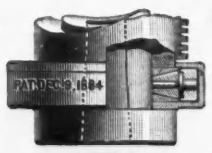

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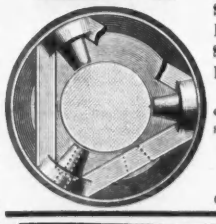

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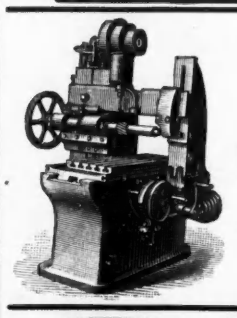

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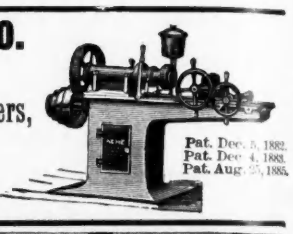

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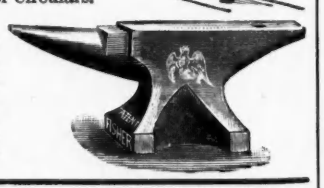

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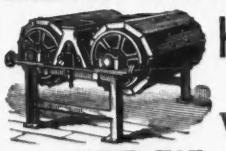

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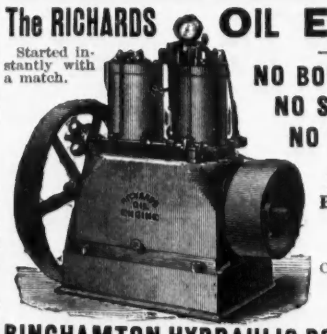

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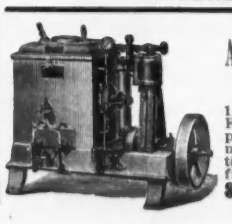

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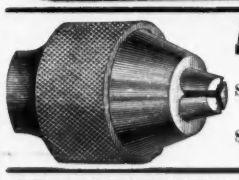

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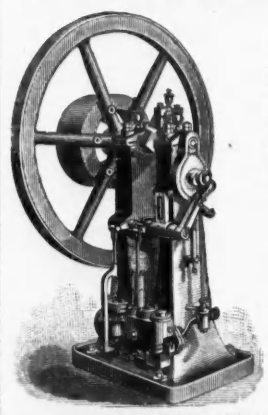

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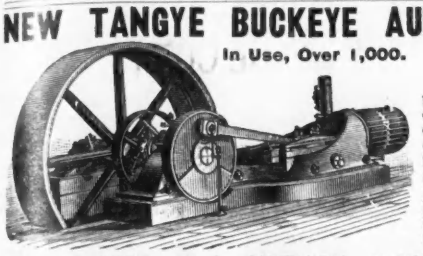

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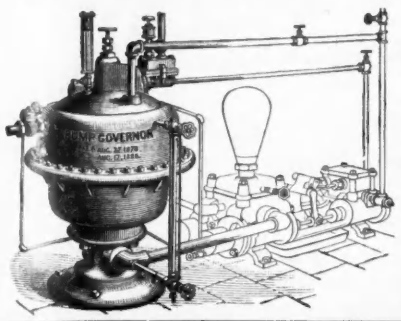

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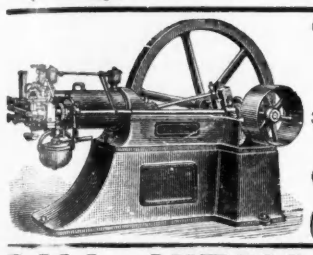

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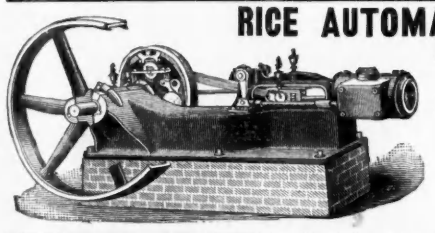

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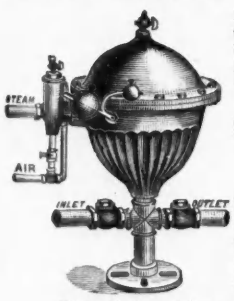

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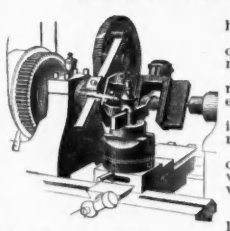

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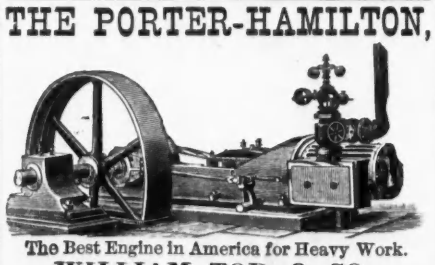

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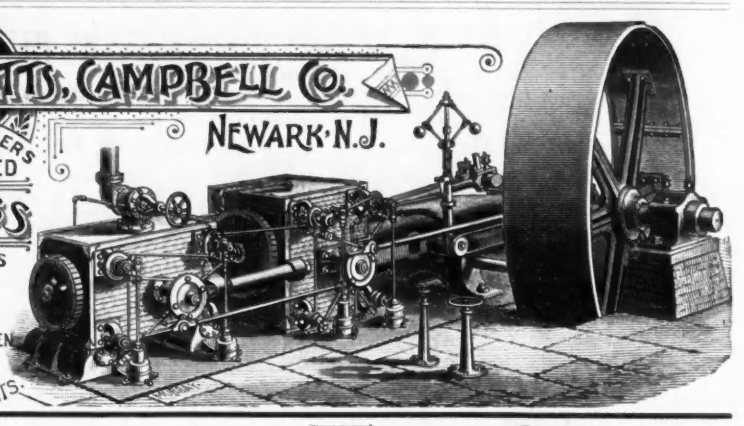

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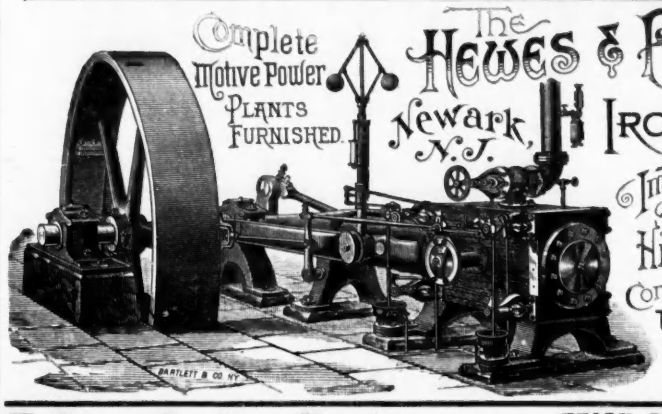

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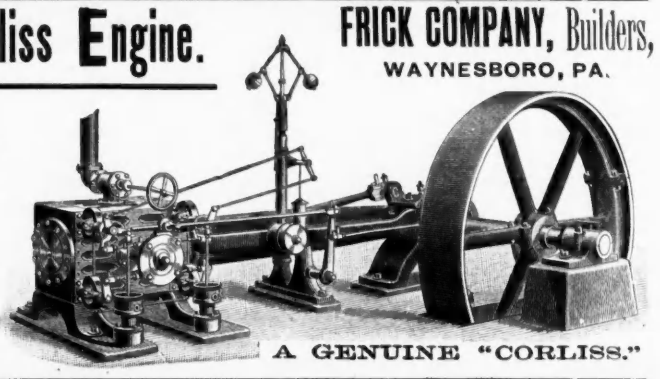

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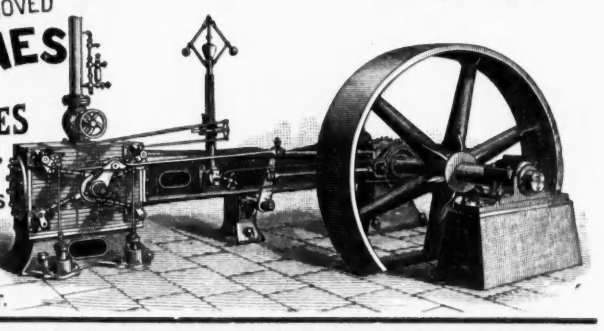

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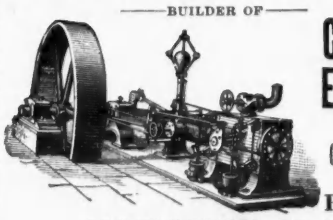

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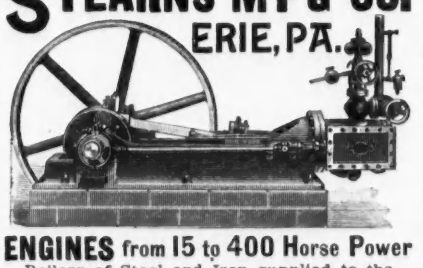

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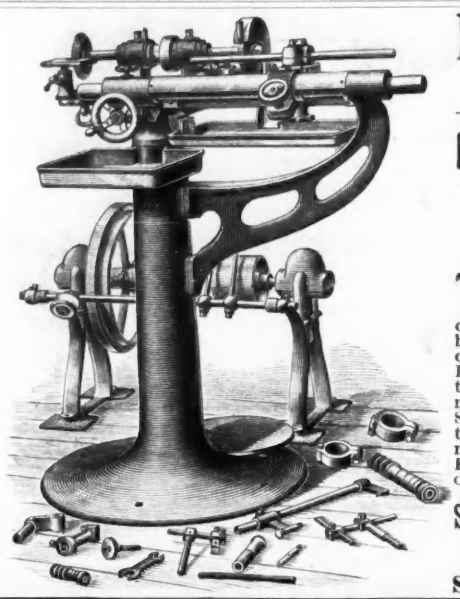

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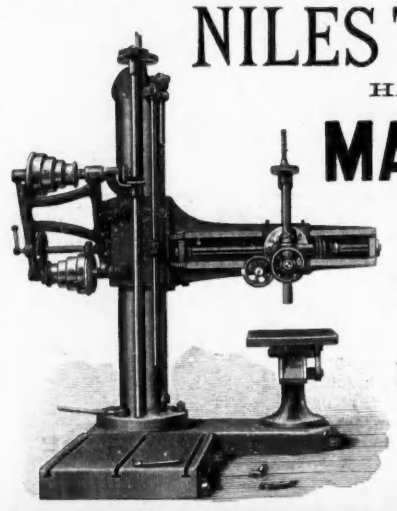

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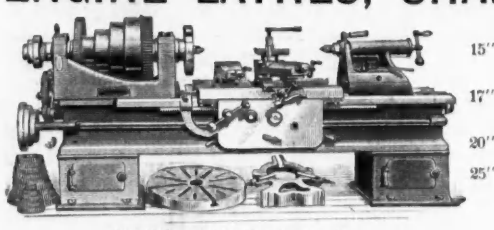

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We consider it a **model tool** and fills the whole bill.

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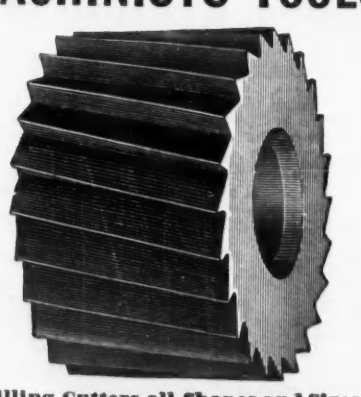

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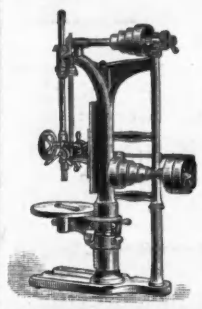

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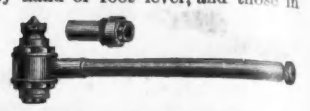

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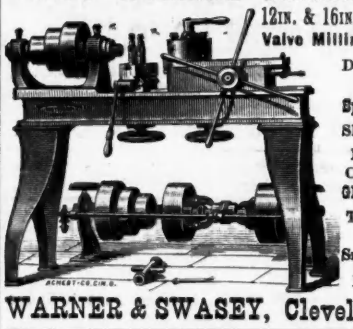

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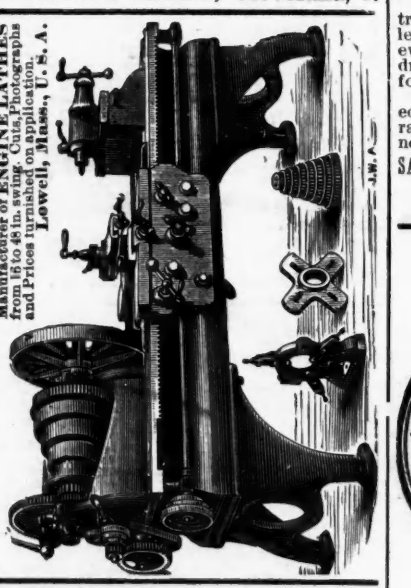

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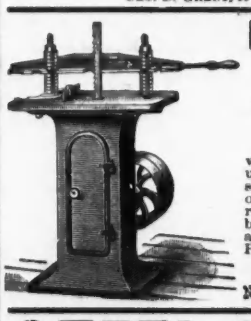

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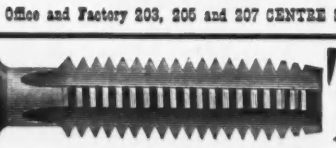

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